# Hawaii WWTP Energy Audits
# “A Virtual Tour”

February, 2010

# Today's Agenda

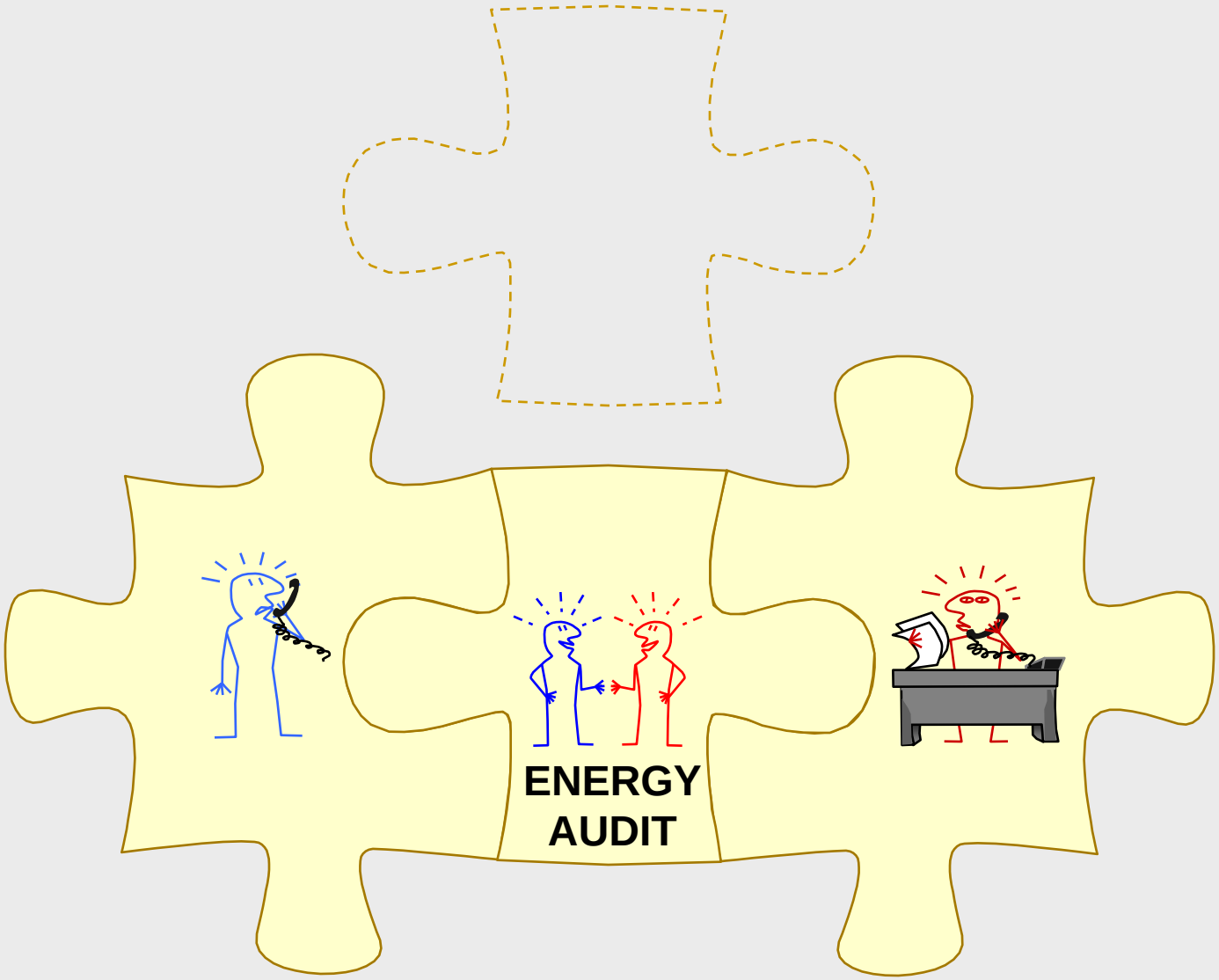
- The energy audit process
- 4 plants 4 stories
- WWTP "Virtual Tour"
- Energy audit do's and don'ts
- Conclusions

# Benefits of Energy Audit?

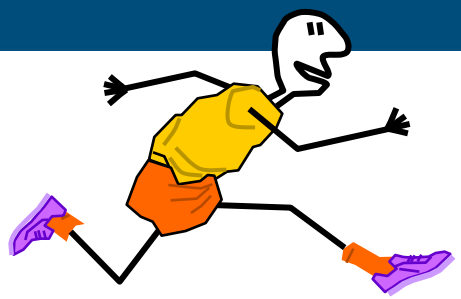
- Improve understanding of processes
- Bridge energy use and accounting
- Gain comprehension of utility bills
- Clarity of energy use and effects
- Improve resource utilization
- Enhance relationship with utility provider
- Improve relationship with rate payers

# Benefits of Energy Audit?

- Recognize your successes
- Goal development
- Reduce operating costs
- Prepare for a renewable future
- Three legged stool: energy efficiency, energy conservation and renewable energy generation


ENERGY
AUDIT
PLANT
UTILITY ACCOUNTING

# Energy Audit - Road Map



START

AUDIT TYPE AND LEVEL

AUDIT TEAM

INFORMATION COLLECTED

ON-SITE AUDIT

ECO DEVELOPMENT AND FUNDING

IMPLEMENT

CONTINUOUS MONITORING

FINISH

# Audit Sequence – Define Audit Type

- Many types of energy audits
  - Equipment audit

    (i.e. pumps, compressed air, lighting)
  - Process audit

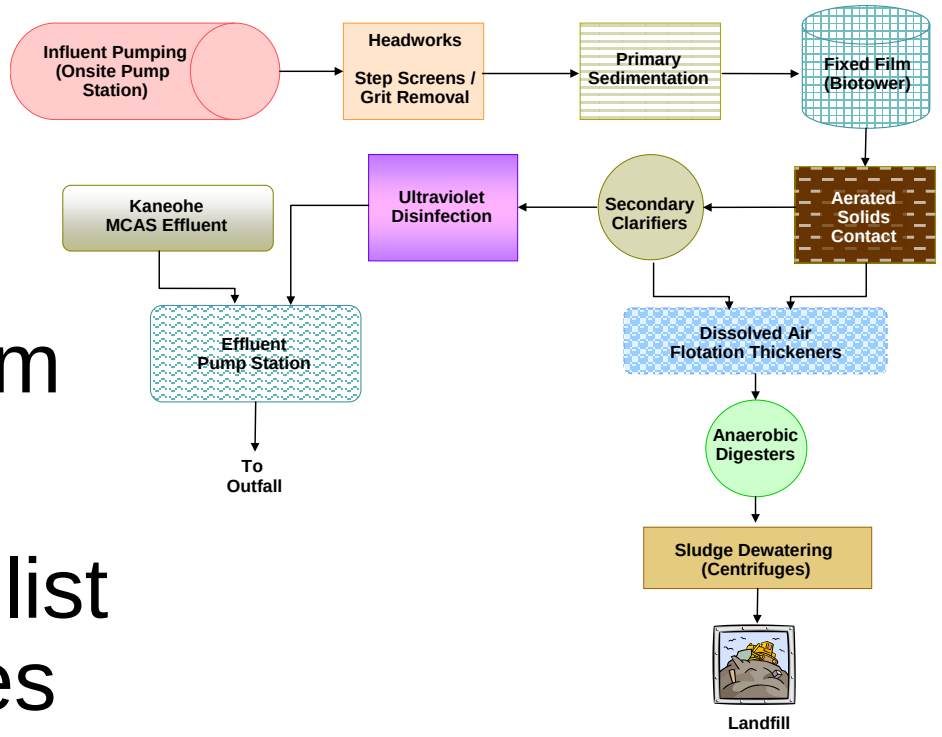
    (i.e. aeration, hydraulic capacity, or overall treatment process)

# Audit Sequence – Define Level of Audit

- Three basic levels
  - **LEVEL I:** preliminary energy use evaluation, identify low-cost/no-cost measures, identify potential capital improvements that merit further analysis
  - **LEVEL II:** more detailed facility survey and energy analysis, develop energy use breakdown, identify practical improvements that meet owners constraints and economic criteria
  - **LEVEL III:** detailed analysis of capital-intensive modifications, requires more field data and engineering analysis, detailed cost and savings information developed for decision making

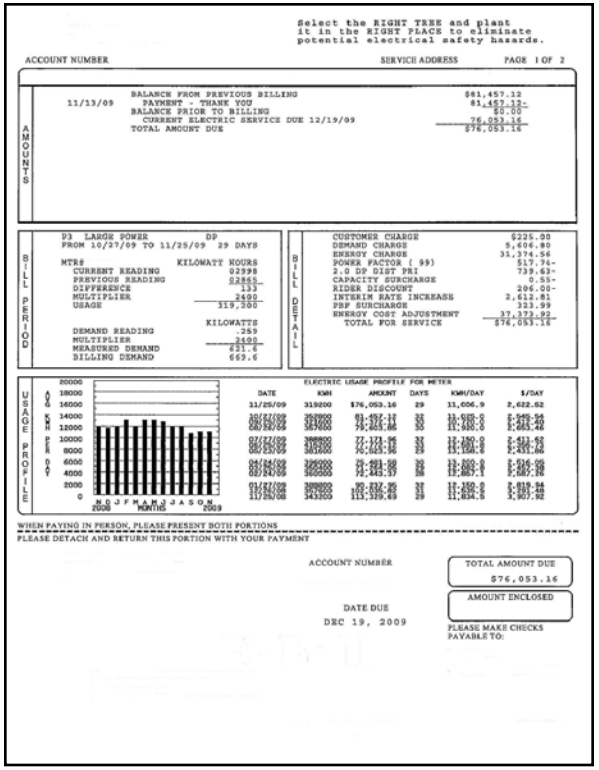
# Audit Sequence – Pre Audit Info Gathering

- Site plan
- All utility bills
- Utility schedules
- Process flow diagram
- Electric diagrams
- Detailed equipment list with installation dates
- Pre site visit analysis



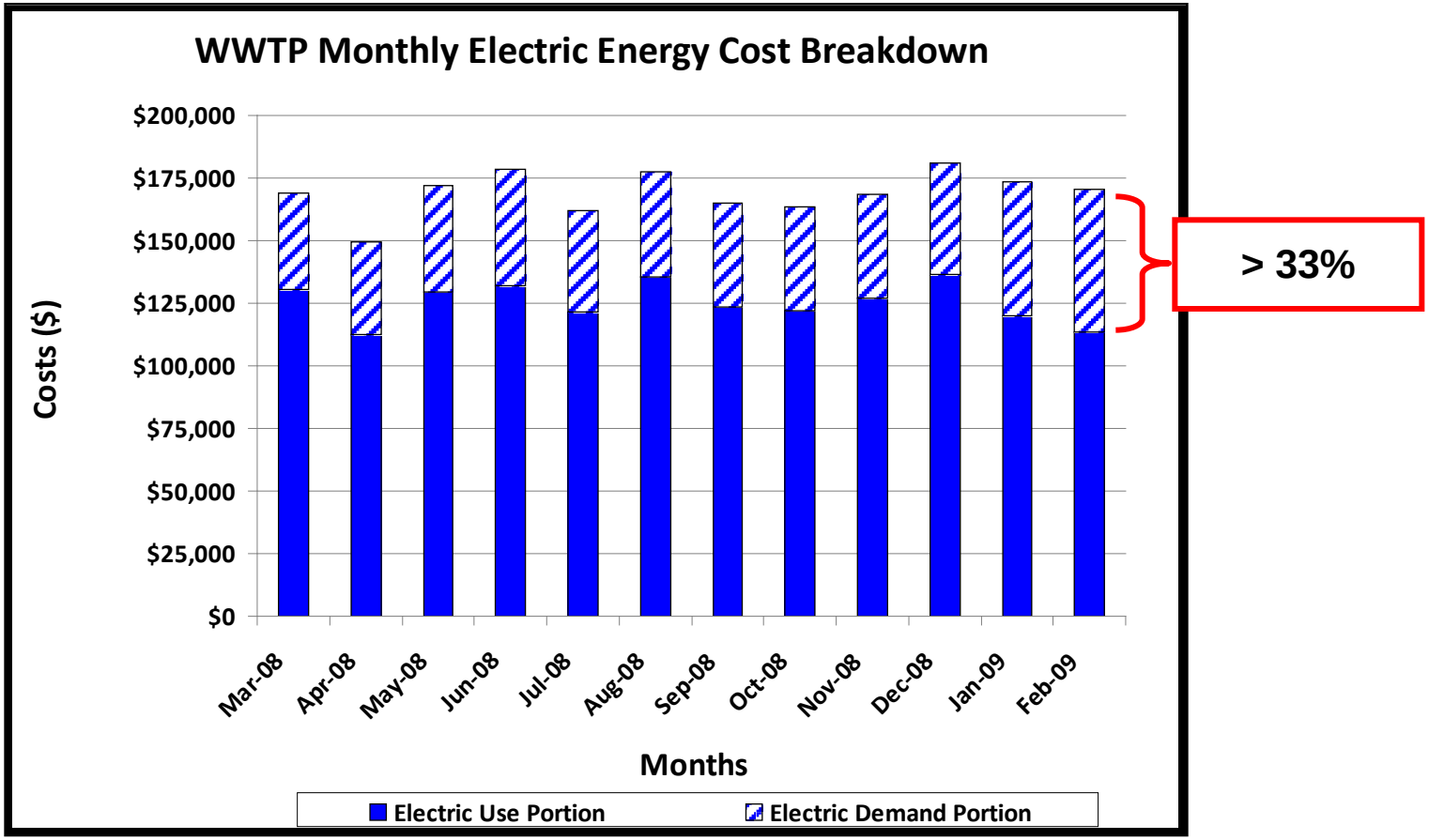
# Audit Sequence – Utility Bill Analysis

- Local rate schedules
- Reconcile energy use
- Create baseline
- Develop energy accounting assumptions
- Minimum 2 yrs of analysis
- Determine demand sensitive operations



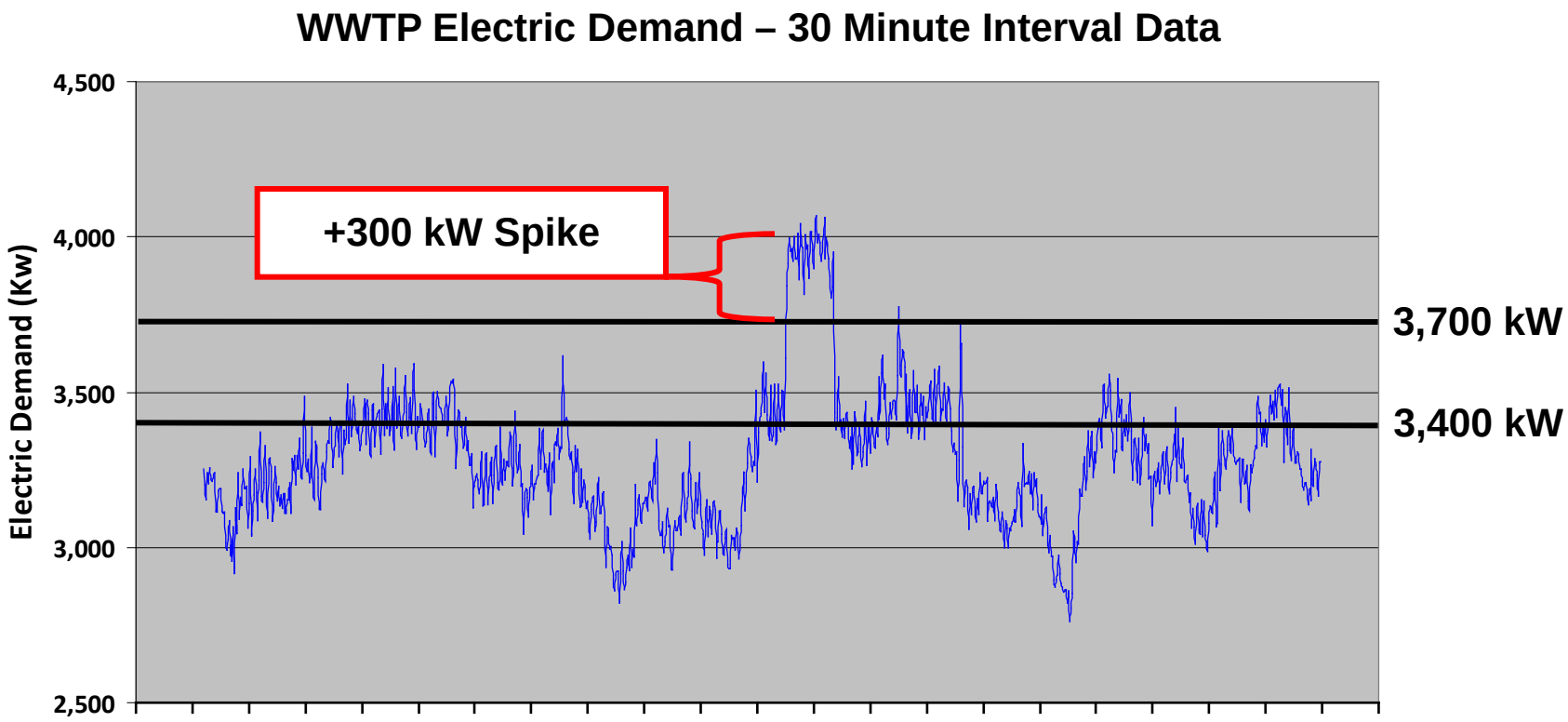
# Audit Sequence – Electric Demand Sensitivity

- Demand can be 15-40% of your elec. costs



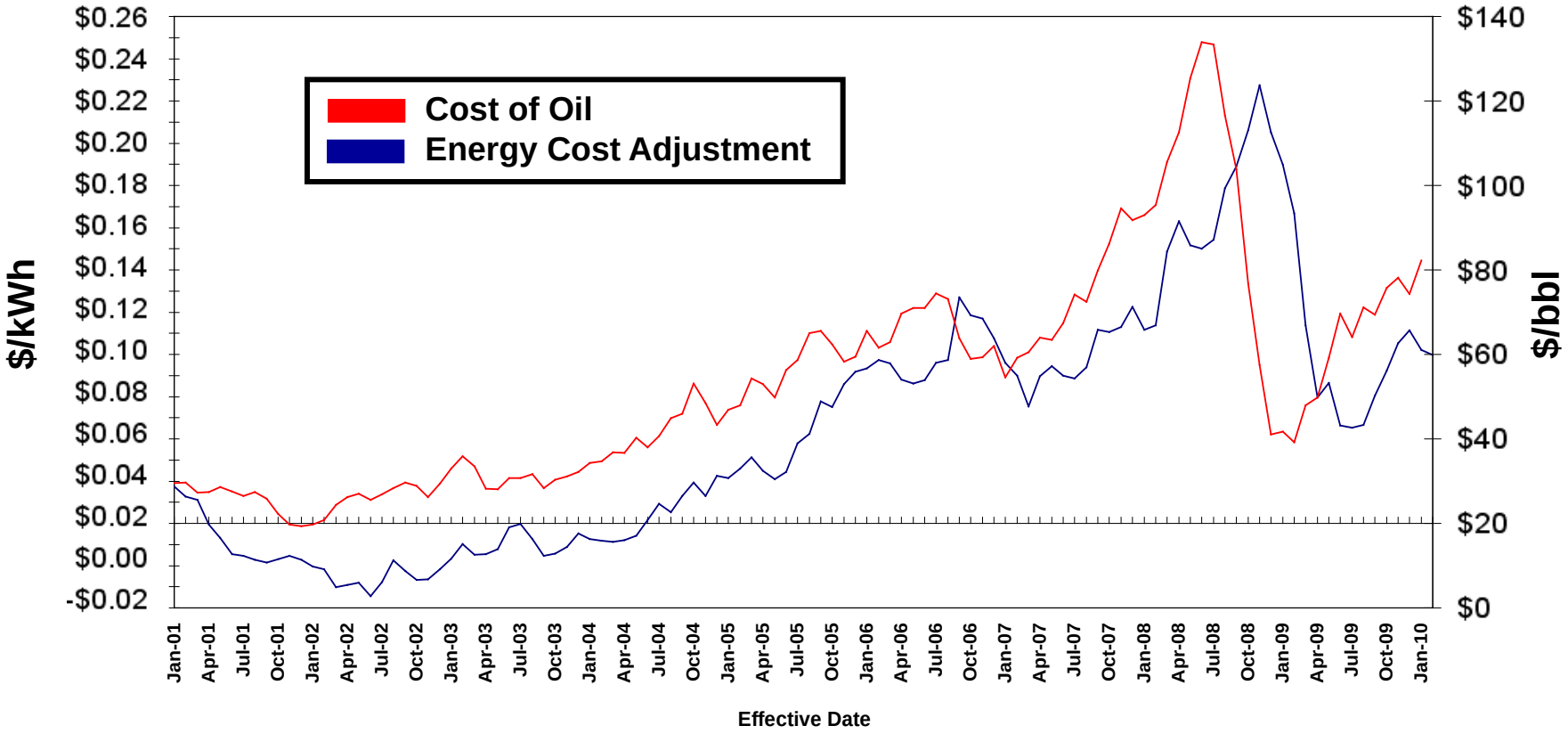
# Audit Sequence – Demand Sensitivity Cont…

- Determining your demand spikes can save $
- 300kW over typical peak demand = $50k/yr



# Audit Sequence – Energy Cost Adjustment

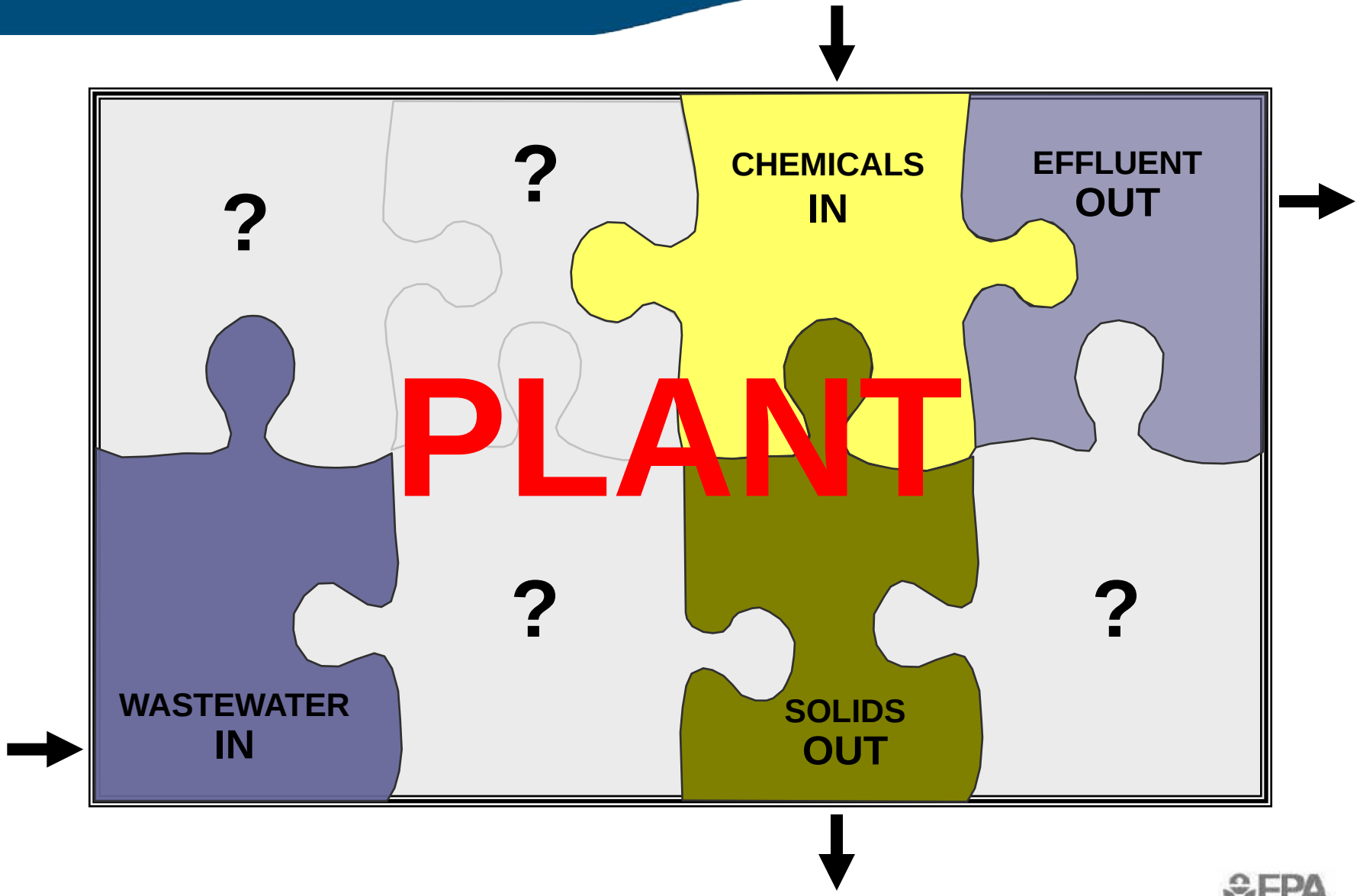
- This factor is somewhat unique to Hawaii
- This factor is added to energy use (kWh)



# Audit Sequence – Baseline & Benchmark

- Goal development – where are you?
- Your personal “Benchmark”
- Framework for strategic planning
- Benchmark analysis allows industry comparison on a “macro level”
- Factor in local considerations
- Benchmark comparison options include: self, regional, national, etc…

# Audit Sequence – What Energy Balance?



# Audit Sequence – Energy Balance Part 1

- Draw boundary (BOX) around plant
- Determine all materials and energy entering and exiting the BOX
  - Influent flow into and through plant
  - Energy and fuel into plant
  - Potable water into plant
  - Effluent flow out of plant
  - Solids out of plant
  - Self-generated energy out of plant

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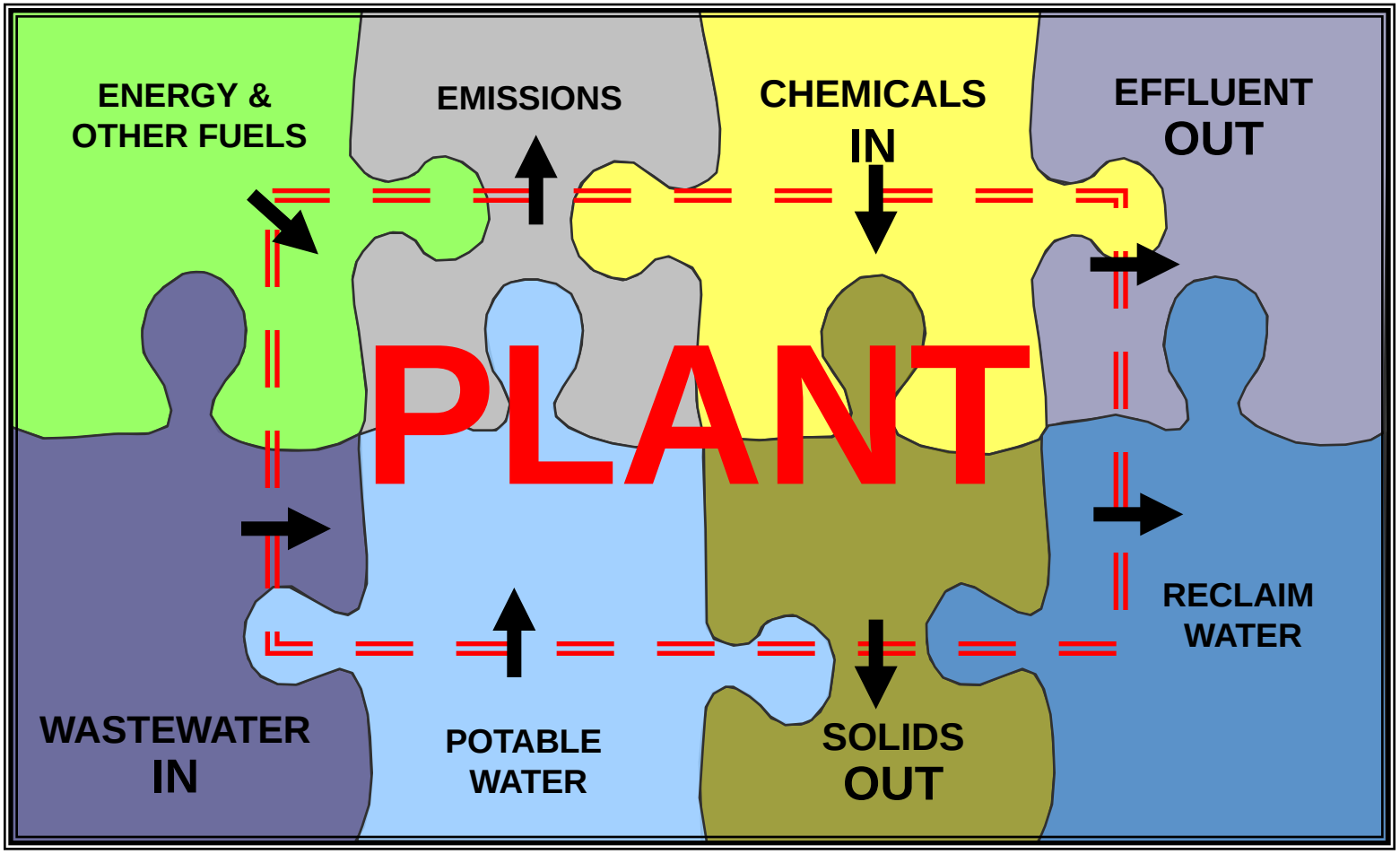
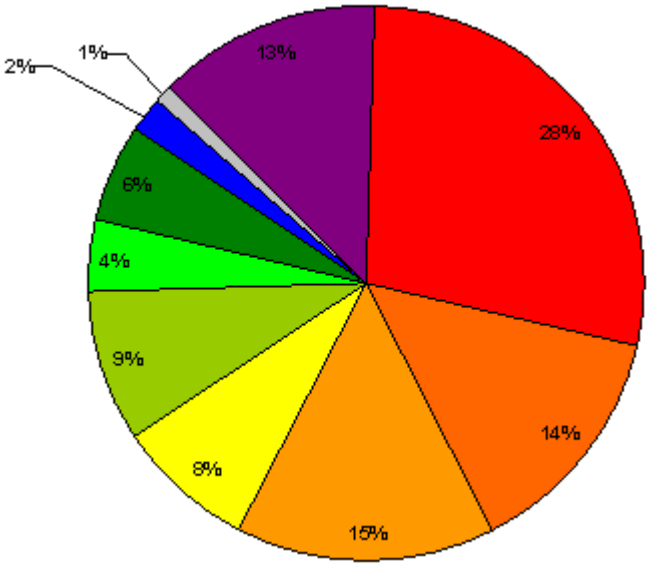
# Audit Sequence – Your Energy Balance!

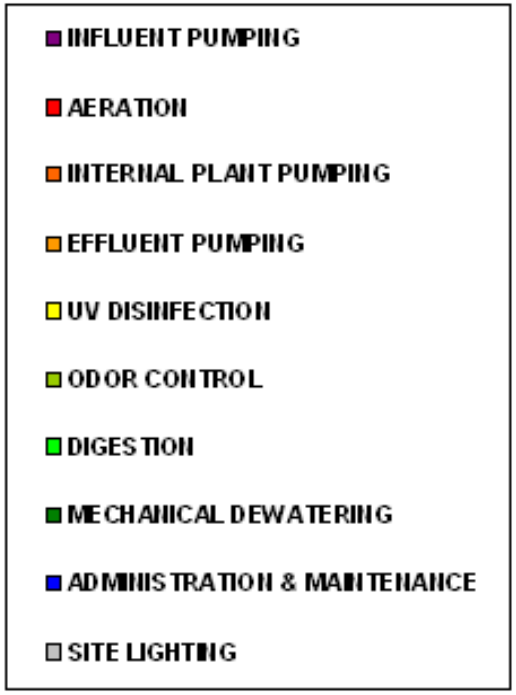


# Audit Sequence – Energy Balance Part 2

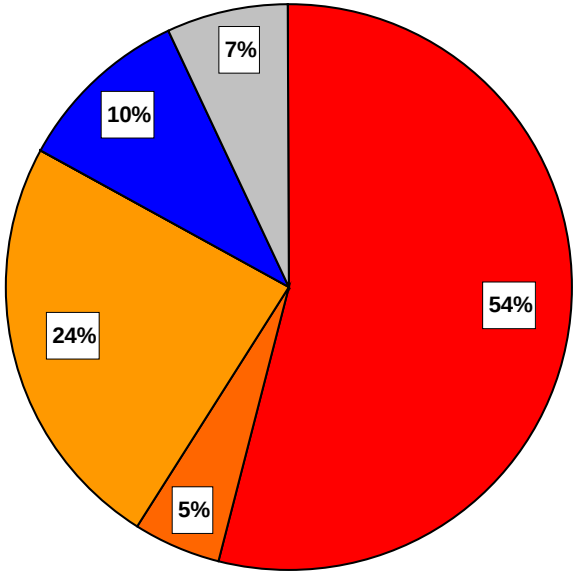
- Develop baseline metrics (e.g.MMBTU$_{eq}$ per MG)
- Analyze energy use for each process type

**PLANT #1**




**PLANT #2**

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# Energy Analysis – ECO Development

- What's an ECO?
- ECO = Energy Conservation Opportunity
- Ask the "Investigative" questions
  - "Why are blowers operating 24/7?"
  - "Why are UV and chlorine disinfection required prior to discharge?"
  - "How efficient is a constant pressure pumping system with variable demands?"
  - "How often does sludge dewatering occur?"

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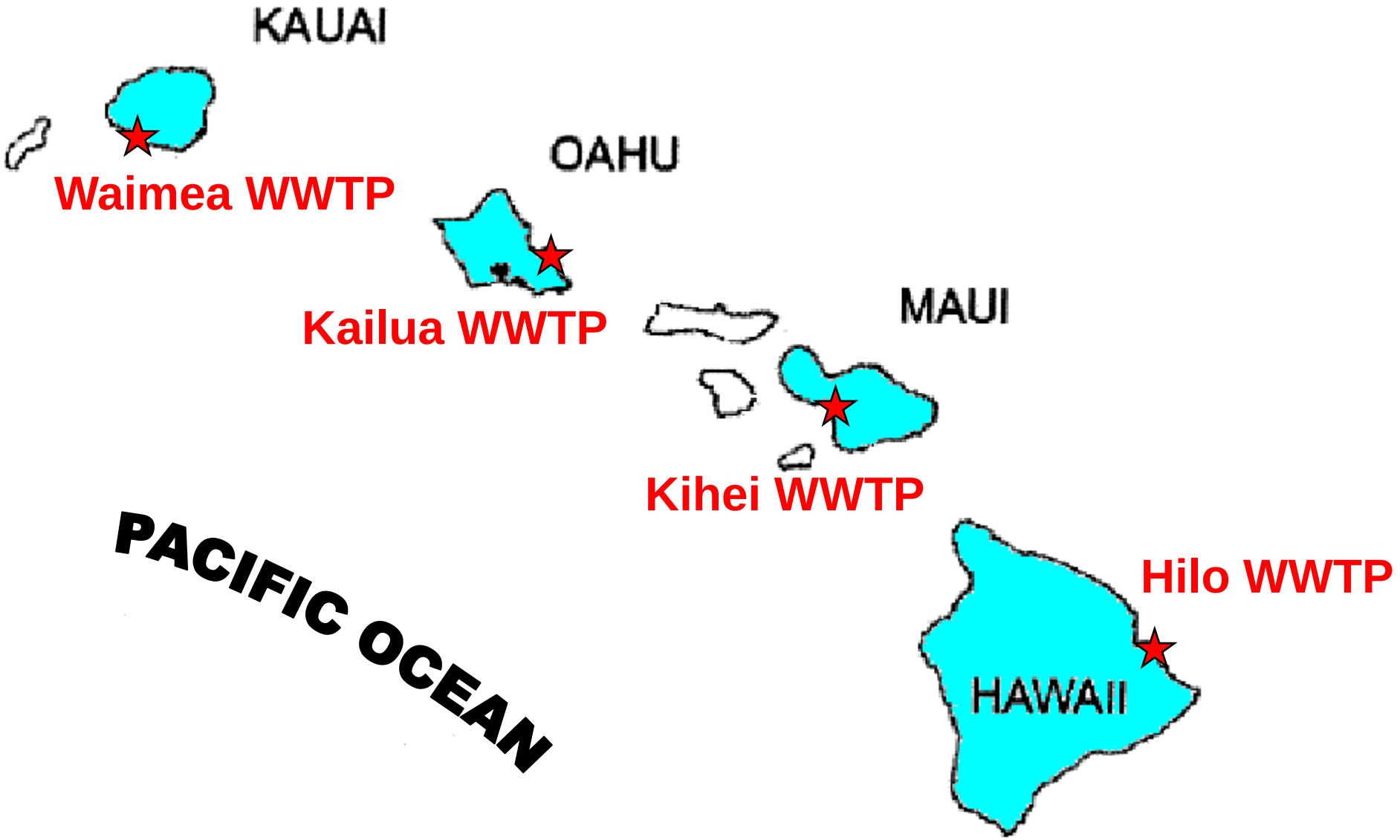
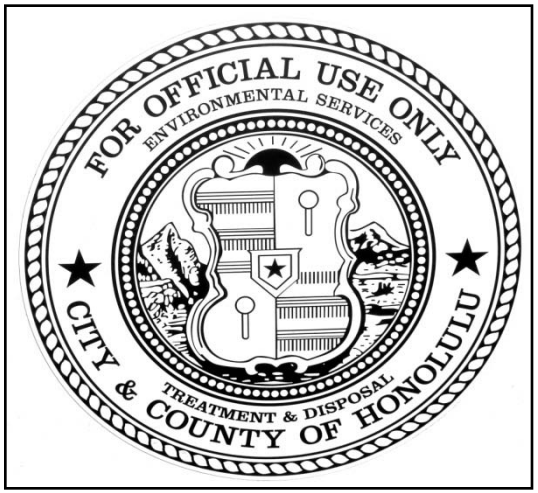
# Energy Analysis – Example ECOs

- High efficiency motors
- Variable operation motors and drives
- Process optimization
- Process replacement
- Schedule modifications
- Water reuse


# The Hawaii Story



# Four Plants…. Four Stories




# Hawaii - *Four Plants, Four Stories*

- Kailua WWTP, Oahu
  - 13 MGD / Fixed film
  - Influent & effluent pumping
  - Comprehensive odor control
  - UV disinfection
  - Anaerobic digestion
- Waimea, Kauai
  - 0.25 MGD / Aeration basins
  - Influent & effluent pumping
  - New treatment plant coming soon
  - Effluent reuse
- Kihei, Maui
  - 3.5 MGD / Aeration Basins
  - Reclaim water & effluent pumping
  - UV disinfection
  - Effluent reuse
- Hilo, Hawaii
  - 2.5 MGD/ Fixed film
  - NO influent & effluent pumping
  - Anaerobic digestion

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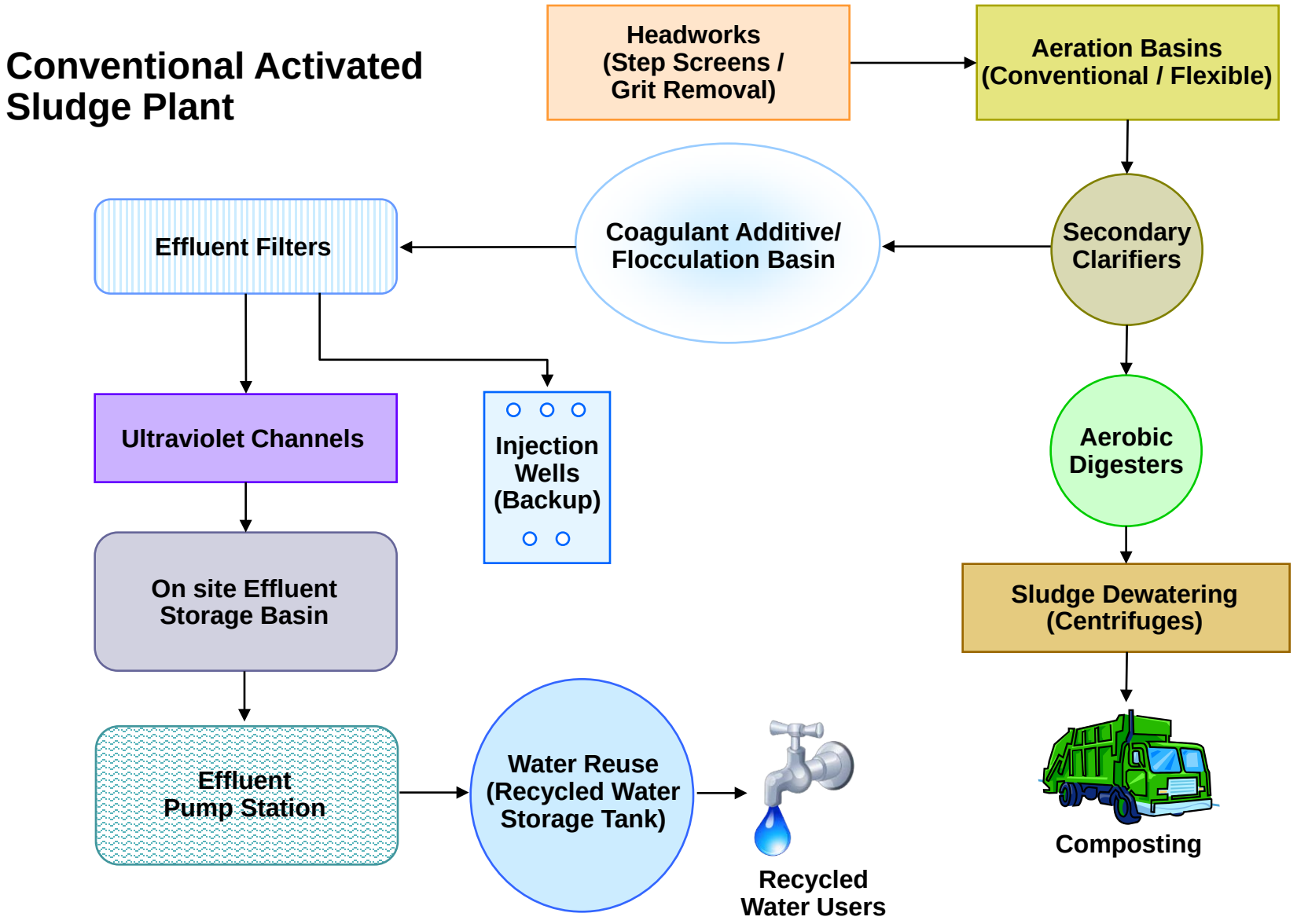
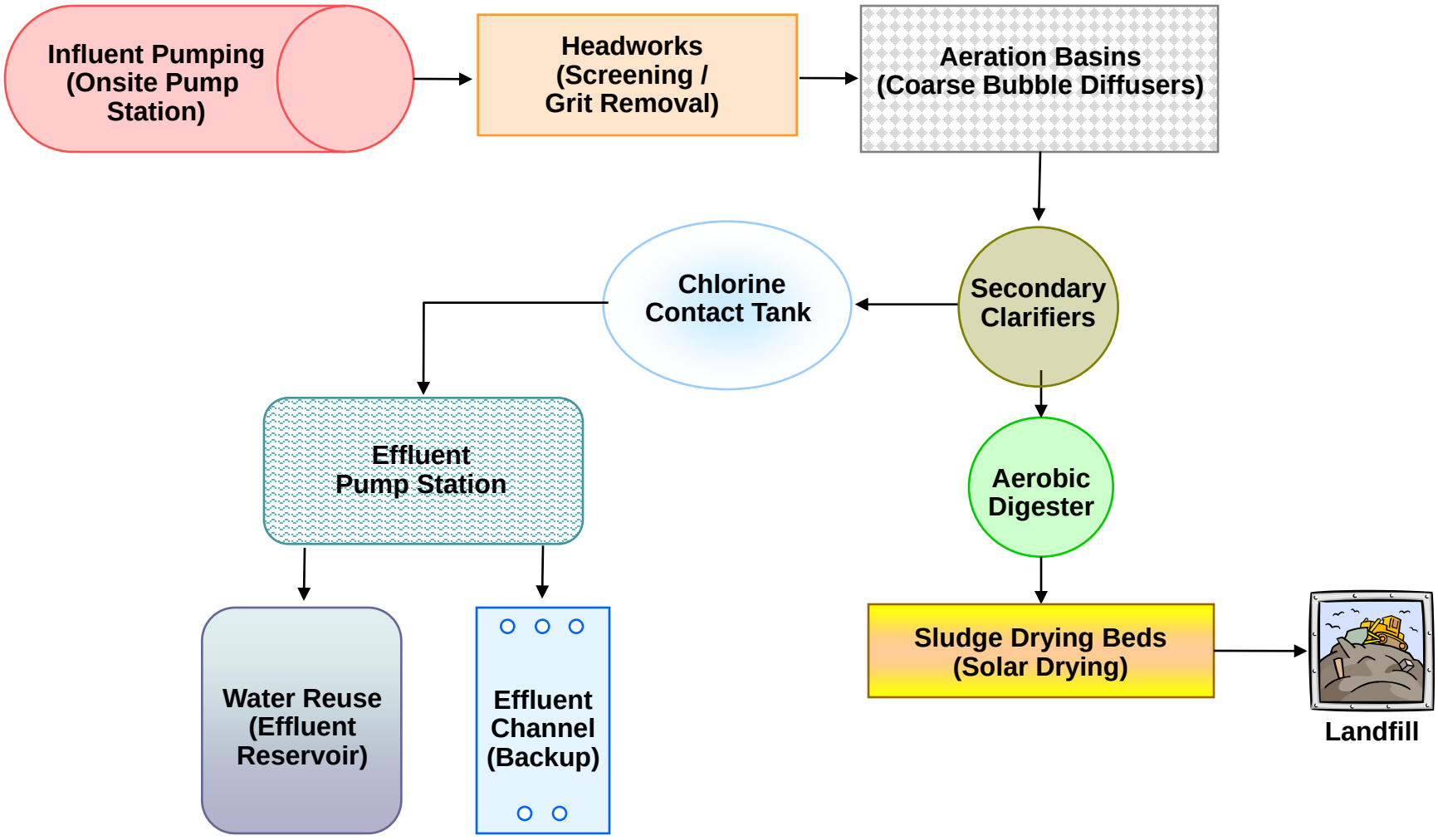
# WWTP Flow Diagram - Kihei

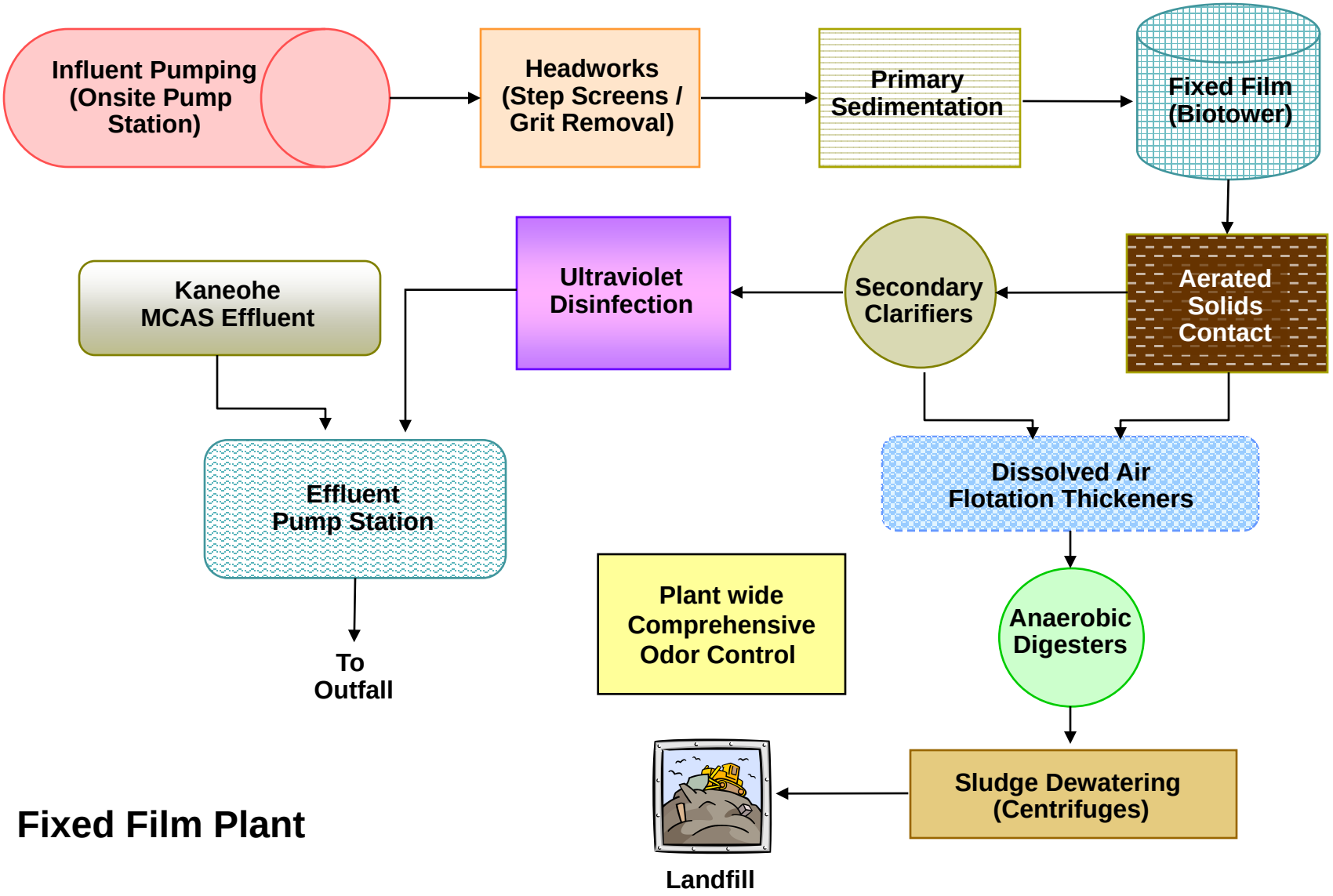


# WWTP Flow Diagram - Waimea

## Conventional Activated Sludge Plant

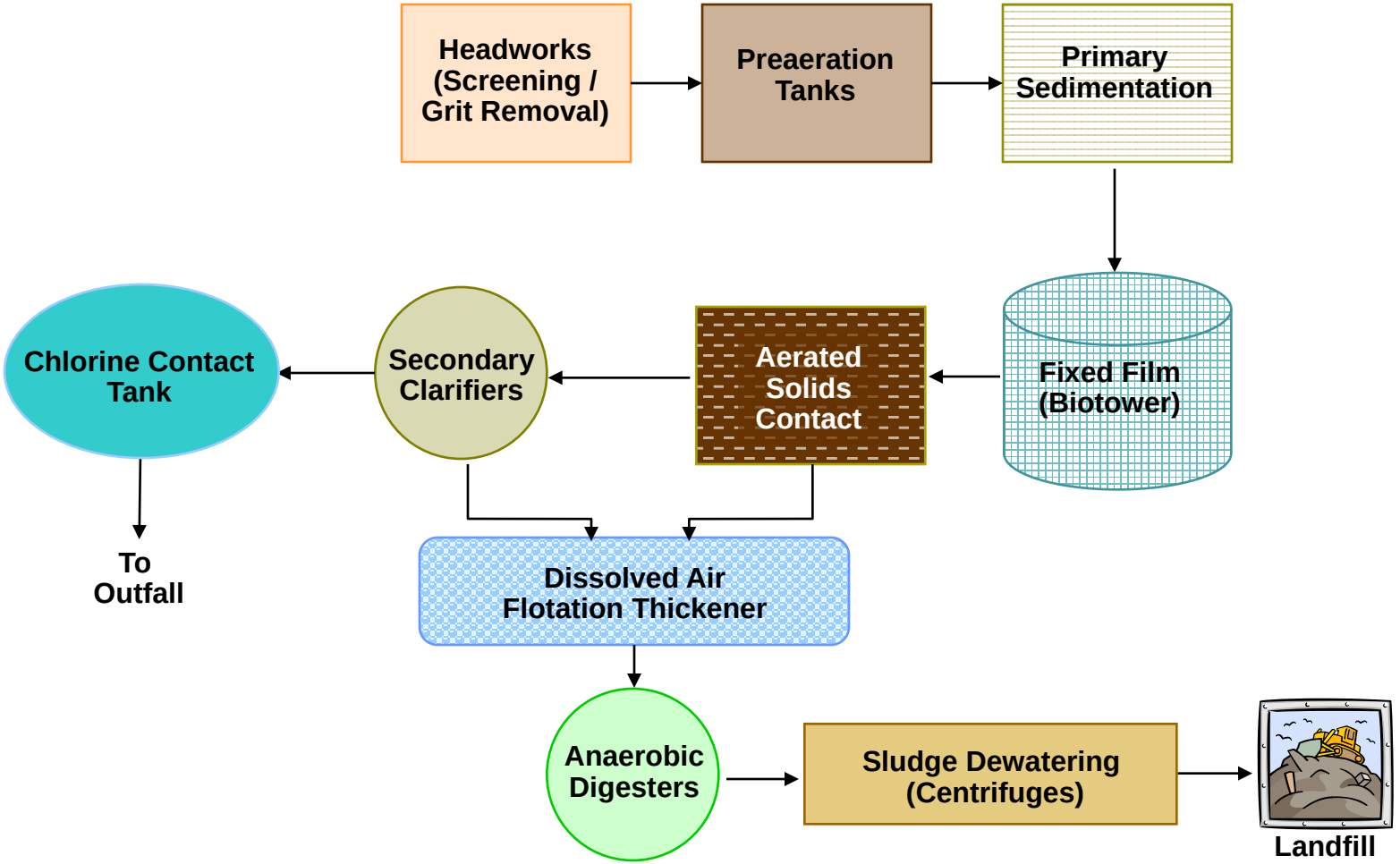


# WWTP Flow Diagram - Kailua




**Fixed Film Plant**

# WWTP Flow Diagram - Hilo

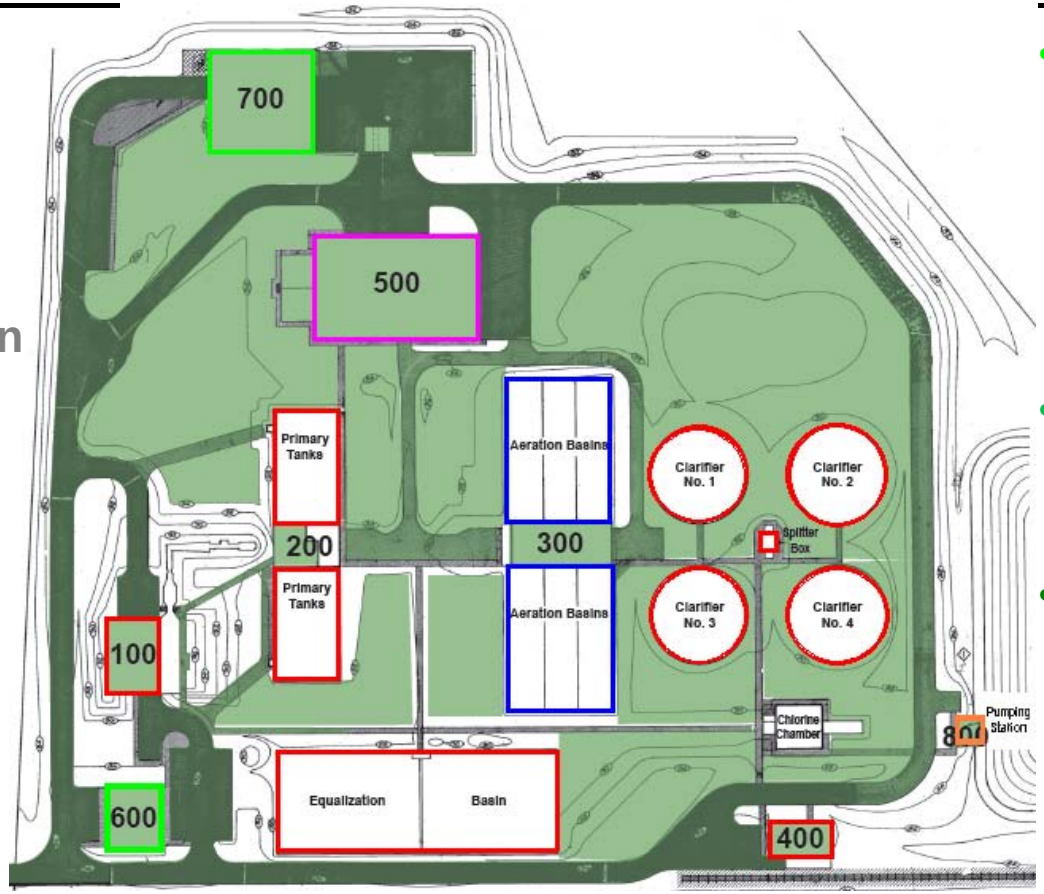



**Fixed Film Plant**

# WWTP – Energy Audit Evaluation Areas

**Process Systems:**

- **Hydraulic Capacity**
- **Aeration**
- **Pumping**
- **Disinfection**
- **Biosolids**



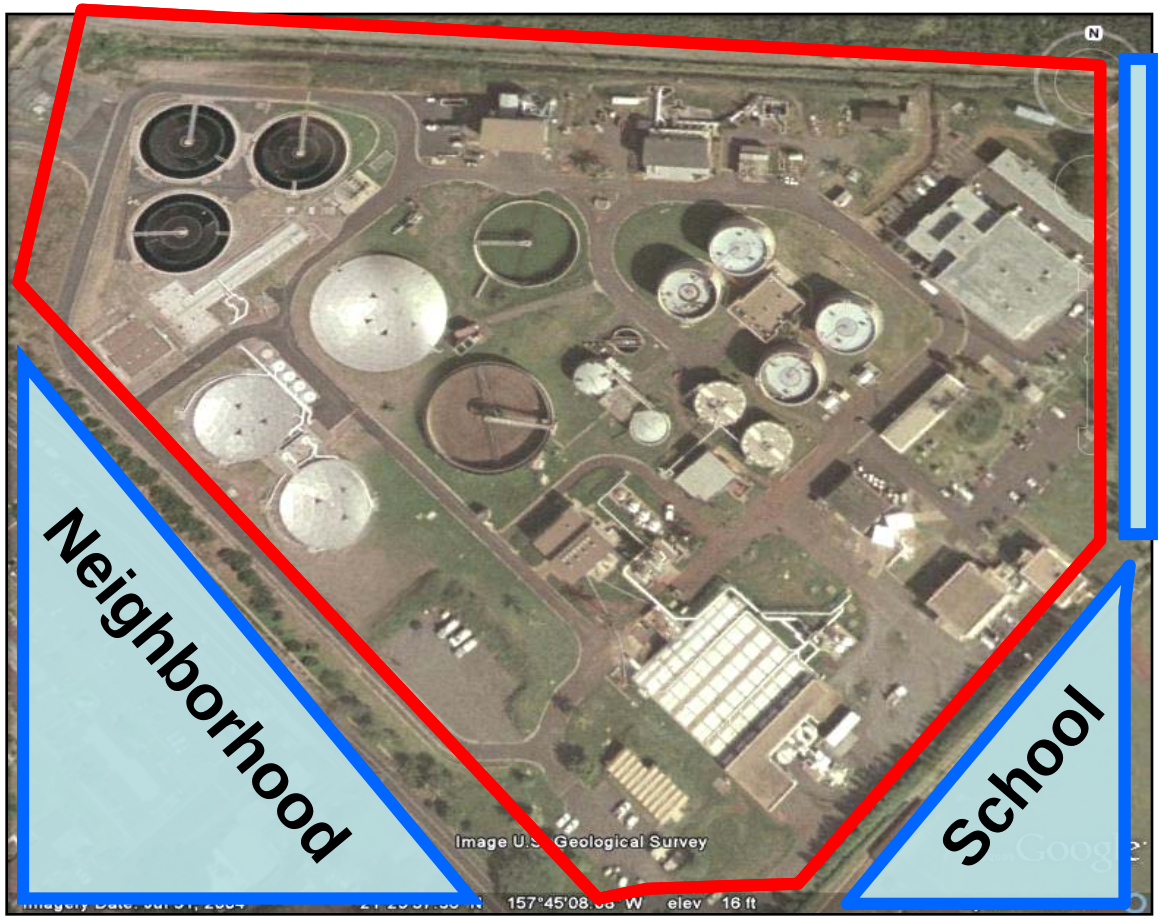

**Non-Process:**

- **Buildings**
  - **Roofs**
  - **Walls**
  - **Lighting**
  - **HVAC**
  - **Space Utilization**
- **Property**
  - **Landscape**
  - **Site Design**
- **Vehicle Options**

**Both:**

- **Maintenance**
- **Reliability**
- **Security**
- **Automation**
- **Behavioral**
- **Site Utilities**
- **Renewable Energy**
- **Procurement**

# WWTP Virtual Tour 1 of 10 – Site Layout




Kailua WWTP Site Layout

- Multiple buildings
- Multiple process systems
- Different operating schedules
- Property limitations
- Odor control issues

# Virtual Tour 2 of 10 – Influent Pumping

- Gravity fed or pumped flow
- Flow control

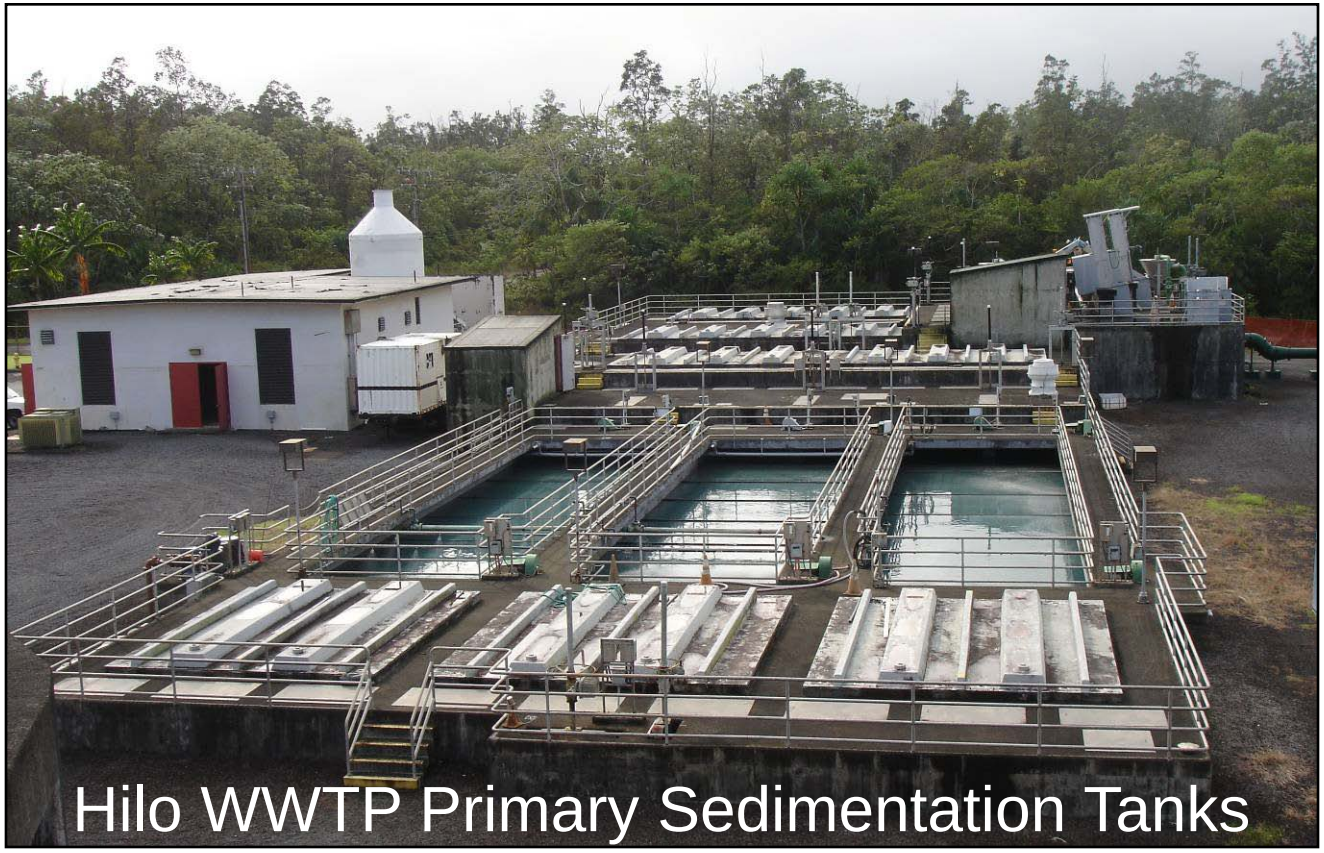
# Virtual Tour 3 of 10 – Pre Treatment

- Screening and solids removal equipment
- Odor control

Kihei WWTP Headworks

# Virtual Tour 4 of 10 – Primary Treatment

- Primary sedimentation tanks
- Wastewater and sludge pumping



Hilo WWTP Primary Sedimentation Tanks

# Virtual Tour 5 of 10 – Secondary Treatment

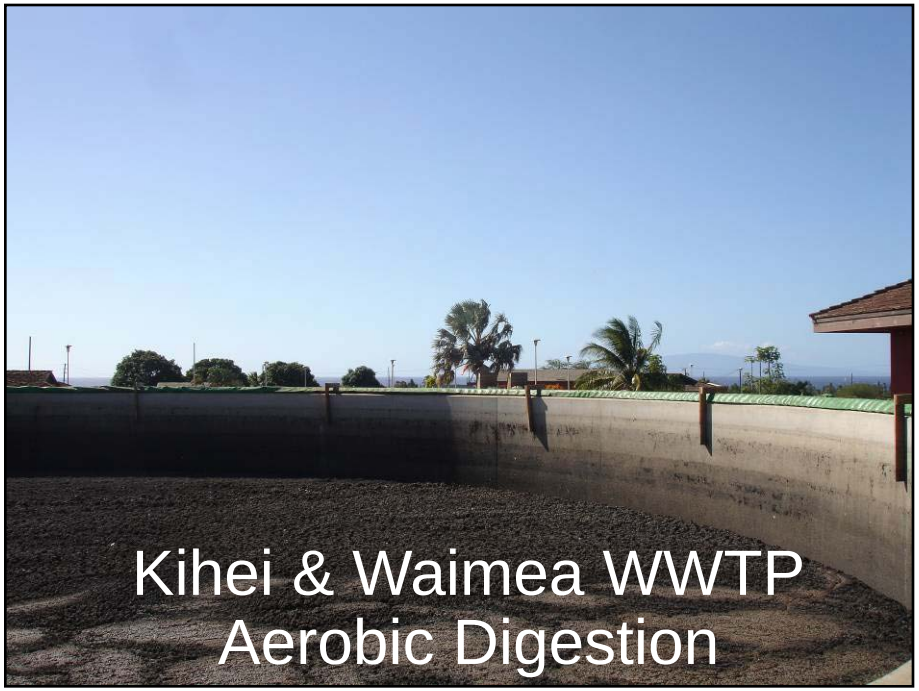
- Fixed film or conventional activate sludge?

Hilo WWTP
Biotowers & Pumps

Kihei WWTP Aeration Basins

# Virtual Tour 6 of 10 – Sludge Treatment

- Methods - digestion, composting and incineration
- Typically depends on amount of solids generated

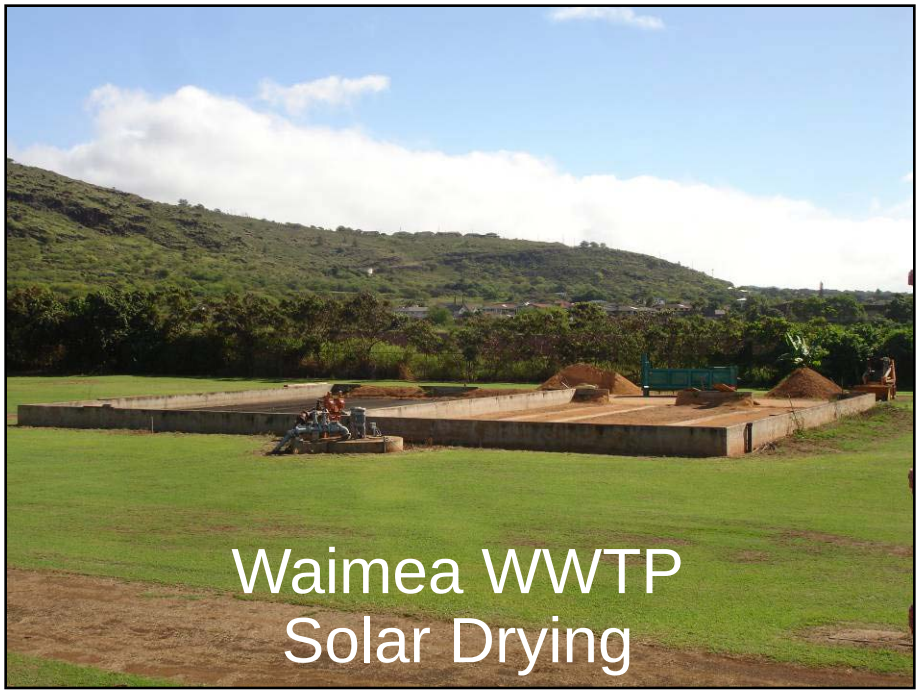

Kihei & Waimea WWTP
Aerobic Digestion


Hilo & Kailua WWTP
Anaerobic Digestion

# Virtual Tour 7 of 10 – Solids Dewatering

- Required to make sludge suitable for disposal
- No process exists to eliminate need for biosolids disposal

Hilo, Kailua & Kihei WWTP
Centrifuging



Waimea WWTP
Solar Drying

# Virtual Tour 8 of 10 – Disinfection

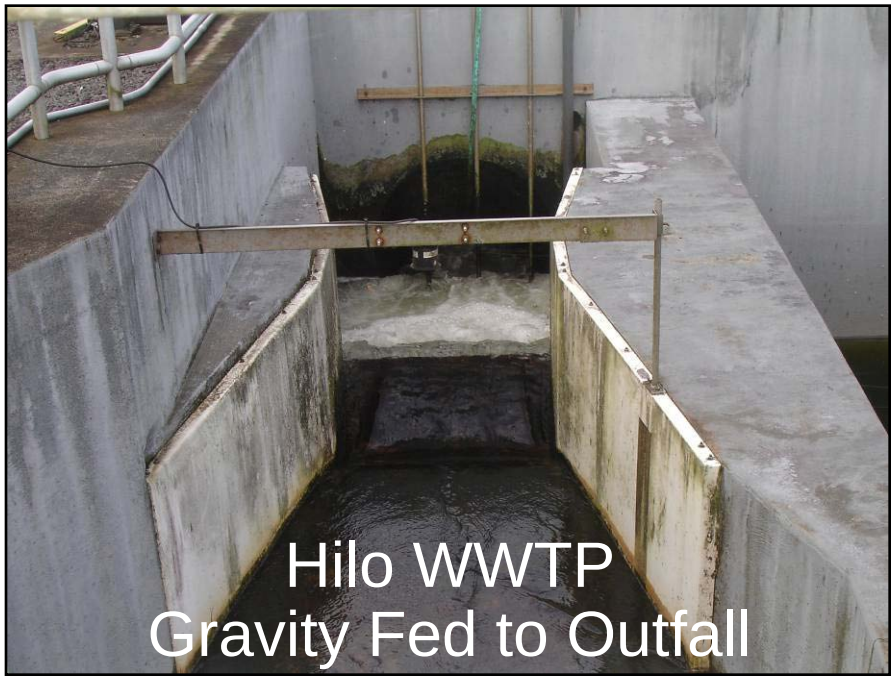
- Methods – ozone, chlorine and ultraviolet (UV) light

Hilo & Waimea WWTP
Chlorination

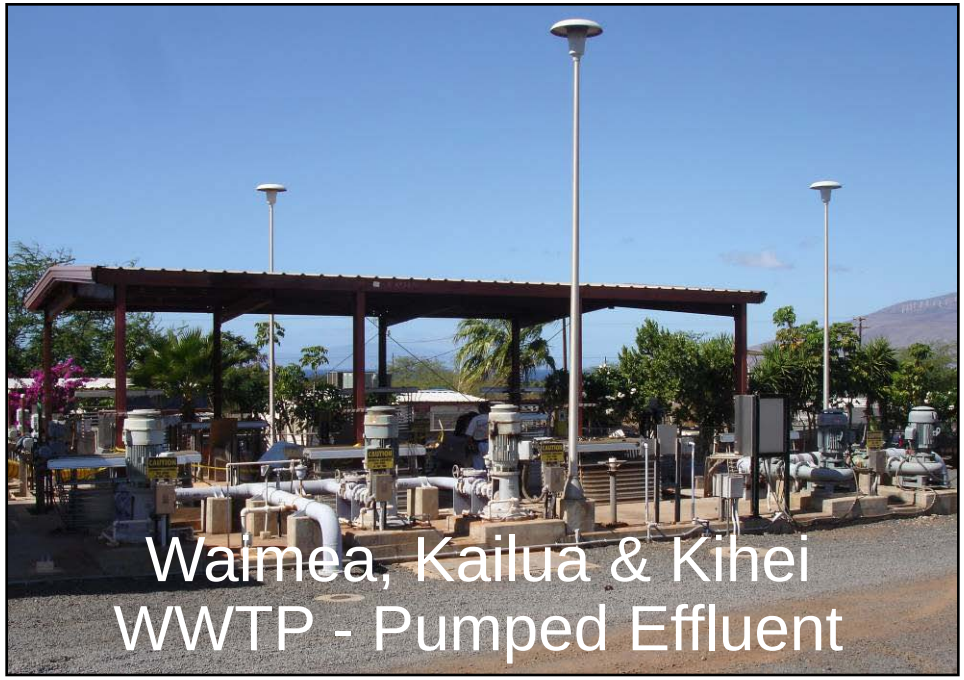

Kailua & Kihei WWTP
Ultraviolet Light

# Virtual Tour 9 of 10 – Effluent Pumping

- Gravity fed or pumped flow
- Flow control
- Water reuse – 2 of 4 WWTP



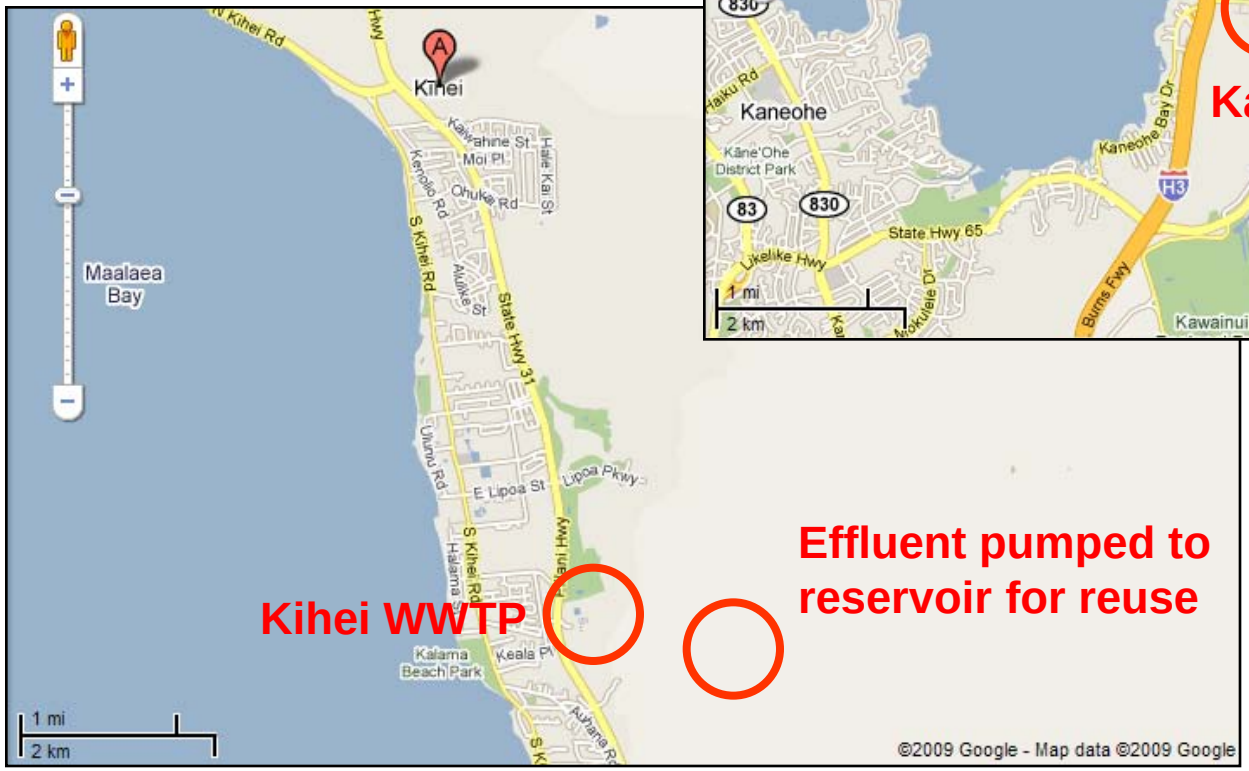
Hilo WWTP
Gravity Fed to Outfall



Waimea, Kailua & Kihei
WWTP - Pumped Effluent

# Virtual Tour 9 of 10 – Effluent Pumping Cont…


# Virtual Tour 9 of 10 – Effluent Pumping Cont…




# Virtual Tour 10 of 10 – Auxiliary Systems

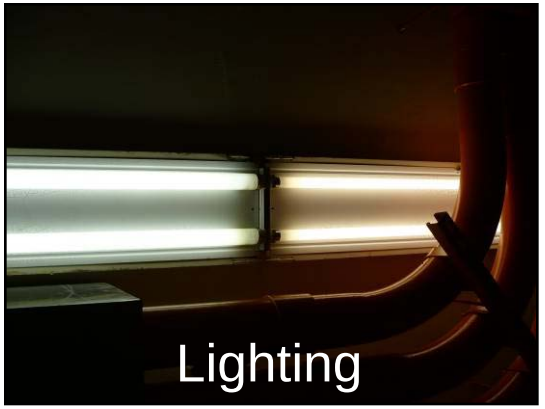
Compressed Air

Odor Control


City Water & Site Booster

Controls & Auto.


Aeration Blowers


Lighting

# Four Stories - Four Unique Circumstances

Considerations associated with auditing infrastructure facilities:

- Every facility is unique with ever-changing and uncontrollable parameters
- Plants have specific process requirements
- Site specific permits, restrictions, regulations and rate structures
- Each plant is located in a unique setting providing potential opportunities and specific issues to overcome

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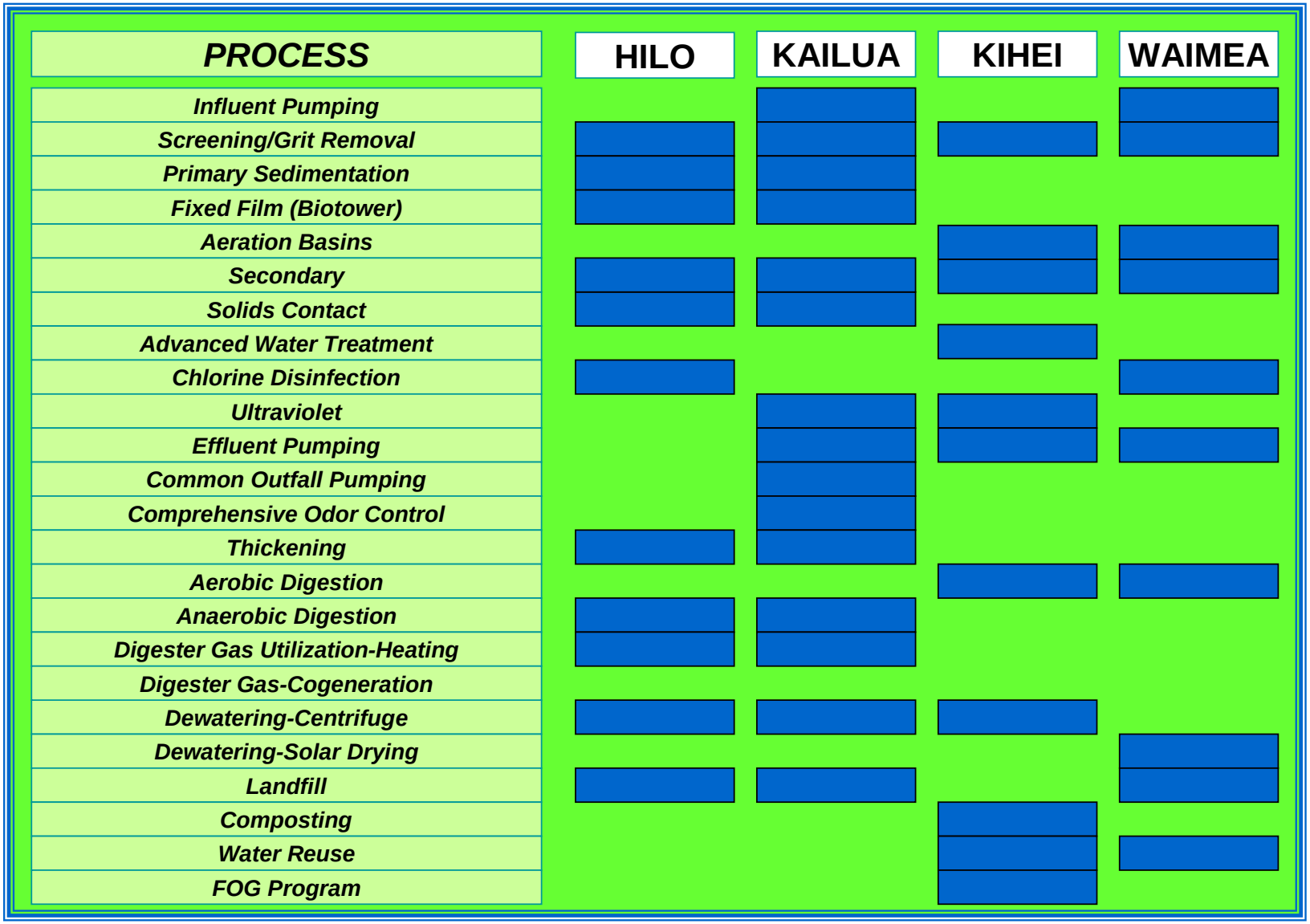
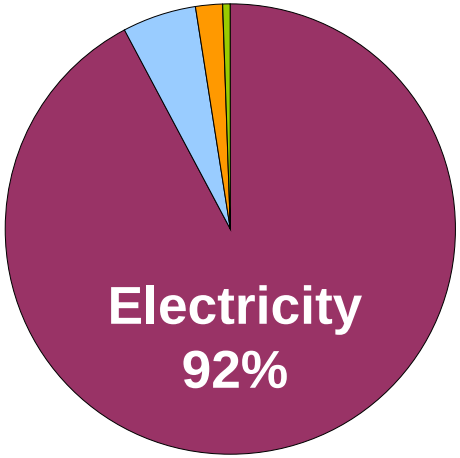
# Comparing “Treatment Plant Unique DNA”

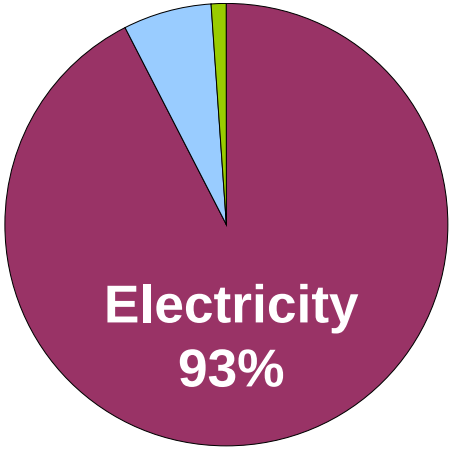


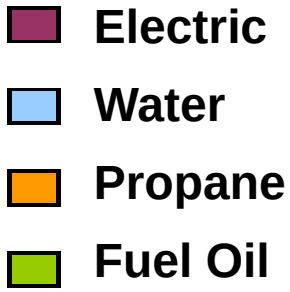
# Resource Cost Breakdown

**Hilo WWTP = $650,000/yr**

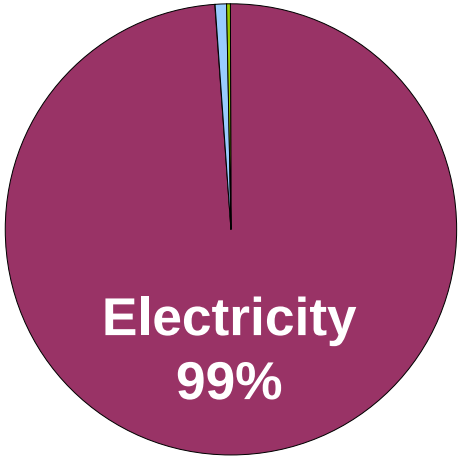



**Kailua WWTP = $1,700,000/yr**

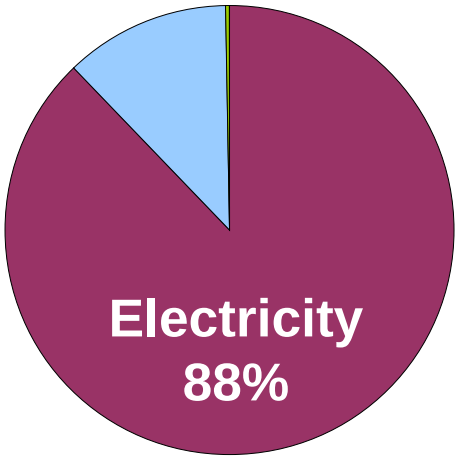



**Kihei WWTP = $1,000,000/yr**




**Waimea WWTP = $100,000/yr**



# Hilo WWTP Electrical Energy Breakdown

| Electrical Energy User / Equipment Description | Est. Electric Energy Use (kWh/yr) | Est. Electric Energy Cost ($/yr) | Est. Electric Energy Use/ Cost (%) |
|---|---|---|---|
| Biotower Pumps | 663,000 | $209,000 | 33% |
| Primary Aeration Blowers | 431,000 | $136,000 | 22% |
| No. 3 Water Pumps | 226,000 | $71,000 | 11% |
| Digester Sludge Mix Pumps | 184,500 | $58,000 | 9% |
| Secondary Aeration Blowers | 74,500 | $23,000 | 4% |
| Solids Processing Odor Ctrl Fan | 76,000 | $24,000 | 4% |
| No. 2 Water Pumps | 51,000 | $16,000 | 3% |
| Grit Pumps | 65,500 | $21,000 | 3% |
| Primary Odor Control Fans | 41,500 | $13,000 | 2% |
| Primary Sludge Pumps | 48,500 | $15,000 | 2% |
| Balance of Plant | 37,000 | $12,000 | 2% |
| Admin/Maint Building Load | 37,000 | $12,000 | 2% |
| Centrifuges | 18,500 | $6,000 | 1% |
| Lighting Load | 17,500 | $6,000 | 1% |
| DAF Thickened Sludge Pumps | 4,700 | $1,000 | 0.2% |
| Digester Sludge Transfer | 3,800 | $1,000 | 0.2% |
| **Est. Annual Electric Use** | **1,980,000** | **$624,000** | **100%** |

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# Kailua WWTP Electrical Energy Breakdown

| Electrical Energy User / Equipment Description | Est. Electric Energy Use (kWh/yr) | Est. Electric Energy Cost ($/yr) | Est. Electric Energy Use/ Cost (%) |
|---|---|---|---|
| Effluent Pumps | 2,189,000 | $442,910 | 28% |
| Biotower Pumps | 1,314,000 | $265,867 | 17% |
| Influent Pumps | 1,139,000 | $230,459 | 14% |
| Secondary Odor Ctrl Fan | 657,000 | $132,934 | 8% |
| Secondary Aeration Blowers | 526,000 | $106,428 | 7% |
| DAF Sludge Pressurization Pumps | 526,000 | $106,428 | 7% |
| Primary Odor Ctrl Fan | 438,000 | $88,622 | 6% |
| Digester Sludge Pumps | 350,000 | $70,817 | 4% |
| Return Activated Sludge Pumps | 228,000 | $46,132 | 3% |
| Admin/Maint Building Load | 174,000 | $35,206 | 2% |
| Centrifuges | 96,000 | $19,424 | 1% |
| Solids Processing Odor Ctrl Fan | 48,000 | $9,712 | 1% |
| Digester Grinders | 71,000 | $14,366 | 1% |
| Centrifuge Sludge Pumps | 38,000 | $7,689 | 0.5% |
| Primary Sludge Pumps | 39,000 | $7,891 | 0.5% |
| Primary Effluent Pumps | 22,000 | $4,451 | 0.3% |
| Waste Activated Sludge Pumps | 13,000 | $2,630 | 0.2% |
| Sludge Thickener Pumps | 15,000 | $3,035 | 0.2% |
| DAF Pocket Pumps | 15,000 | $3,035 | 0.2% |
| Primary Grit Pumps | 11,000 | $2,226 | 0.1% |
| Primary Scum Pumps | 11,000 | $2,226 | 0.1% |
| **Est. Annual Electric Use** | **7,920,000** | **$1,602,489** | **100%** |

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# Kiehi WWTP Electrical Energy Breakdown

| Electrical Energy User / Equipment Description | Est. Electric Energy Use (kWh/yr) | Est. Electric Energy Cost ($/yr) | Est. Electric Energy Use/ Cost (%) |
|---|---|---|---|
| Primary Aeration Blowers | 1,707,900 | $368,231 | 39% |
| Effluent Pumps | 867,000 | $186,929 | 20% |
| Aerobic Digester Agitation Blowers | 263,000 | $56,704 | 6% |
| Sand Filter Sump Pumps | 263,000 | $56,704 | 6% |
| Plant Air Compressors | 270,500 | $58,321 | 6% |
| Admin/Maint Building Load | 31,500 | $6,792 | 1% |
| Clarifier #1 & #2 RAS Pumps | 158,000 | $34,065 | 4% |
| Influent Odor Control Fan | 118,000 | $25,441 | 3% |
| Filter Compressor Station | 118,000 | $25,441 | 3% |
| Reclaim Transfer Pumps | 118,000 | $25,441 | 3% |
| Balance of Plant | 144,500 | $31,155 | 3% |
| Centrifuges | 79,000 | $17,033 | 2% |
| UV Disinfection System | 80,000 | $17,248 | 2% |
| WAS Pumps #1 - #5 | 40,500 | $8,732 | 1% |
| Anoxic Mixing Aeration Blowers | 22,500 | $4,851 | 1% |
| Plant Utility Water Pumps | 54,000 | $11,643 | 1% |
| Lighting Load | 42,000 | $9,055 | 1% |
| Digested Sludge Pumps | 7,000 | $1,509 | 0.2% |
| **Est. Annual Electric Use** | **4,384,400** | **$945,296** | **100%** |

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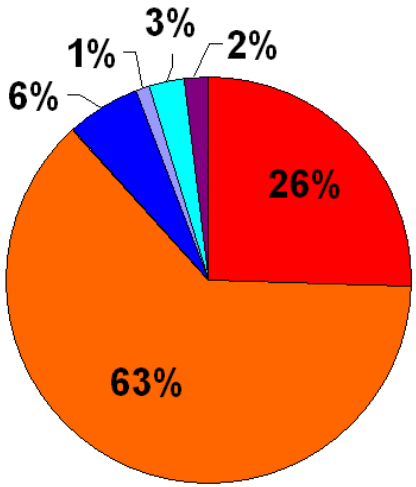
# Waimea WWTP Electrical Energy Breakdown

| Electrical Energy User / Equipment Description | Est. Electric Energy Use (kWh/yr) | Est. Electric Energy Cost ($/yr) | Est. Electric Energy Use/ Cost (%) |
|---|---|---|---|
| Primary Aeration Blowers | 202,100 | $58,674 | 65% |
| Effluent Pumps | 46,340 | $13,454 | 15% |
| Influent Pumps | 21,800 | $6,329 | 7% |
| Balance of Plant | 17,520 | $5,086 | 6% |
| Admin/Maint Building Load | 13,100 | $3,803 | 4% |
| Lighting Load | 11,300 | $3,281 | 4% |
| Sludge Drying Bed Underdrain Pumps | 430 | $125 | 0.1% |
| **Est. Annual Electric Use** | **312,590** | **$90,752** | **100%** |

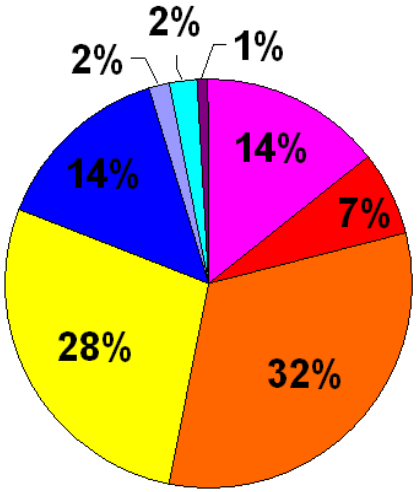
EPA

# WWTP Electrical Energy Breakdowns

**Hilo WWTP**
**1,980,000 kWh/yr**

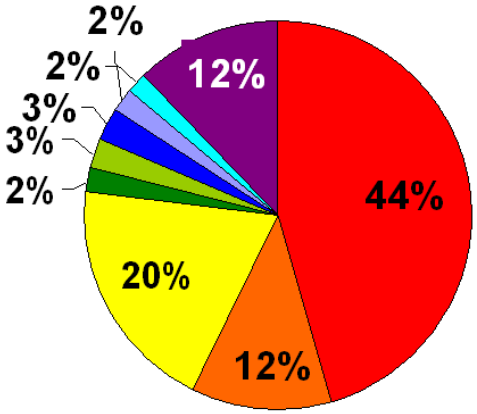



**Kailua WWTP**
**7,920,000 kWh/yr**

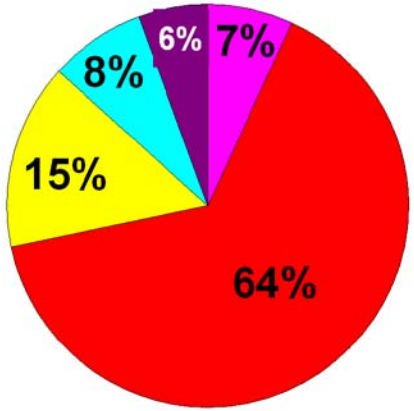



- Influent Pumping
- Aeration
- Internal Plant Pumping
- Effluent Pumping
- UV Disinfection
- Reclaim Water Treatment
- Odor Control
- Mechanical Dewatering
- Facility/Buildings & Lighting
- Balance of Plant

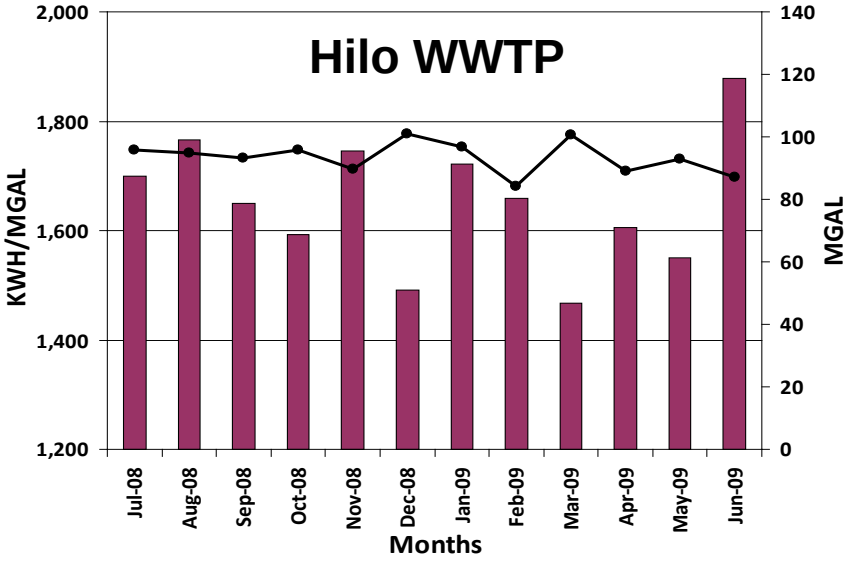
**Kihei WWTP**
**4,384,000 kWh/yr**

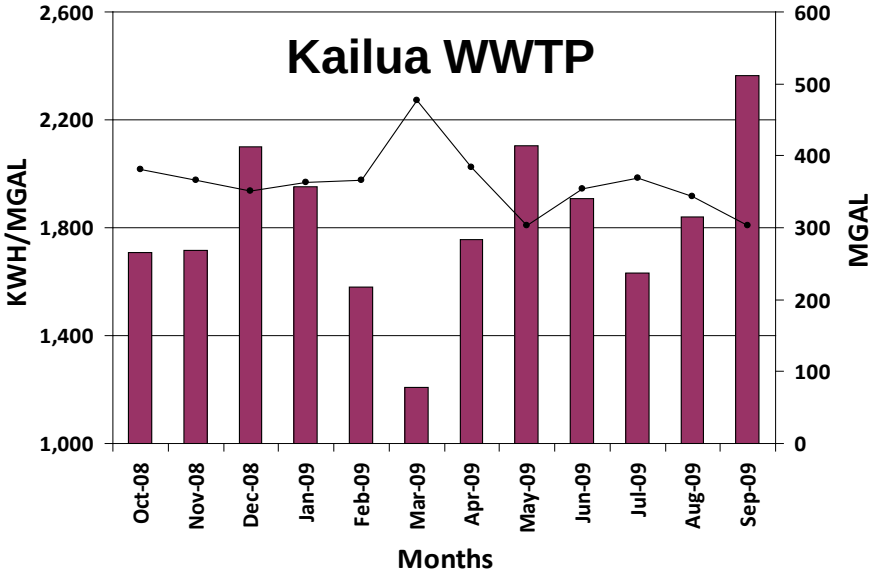


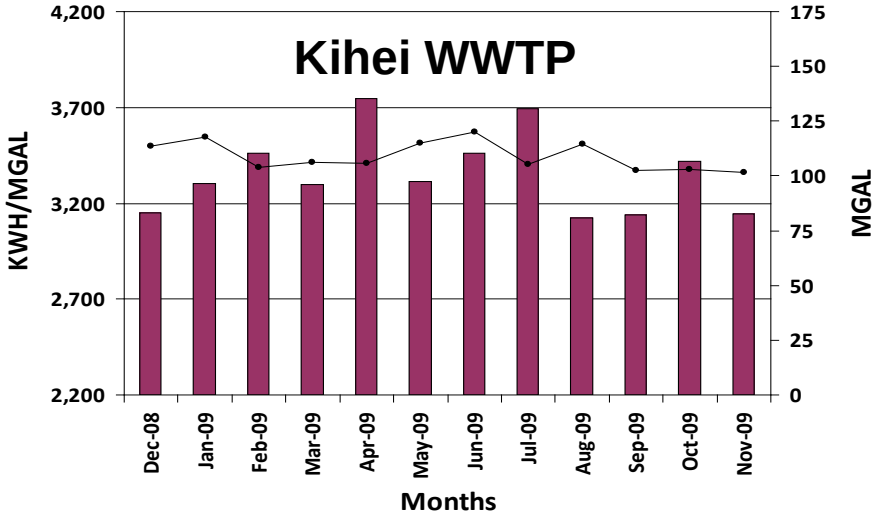

**Waimea WWTP**
**313,000 kWh/yr**

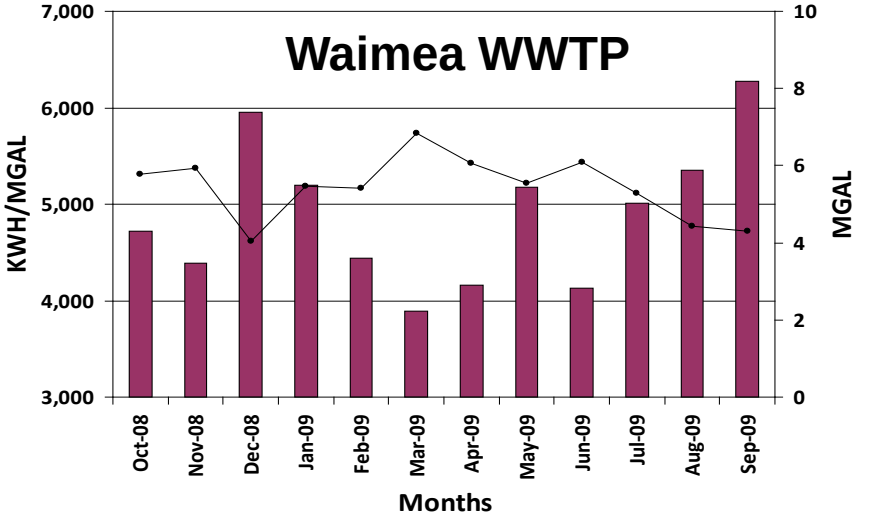


# Current Plant Energy Baselines



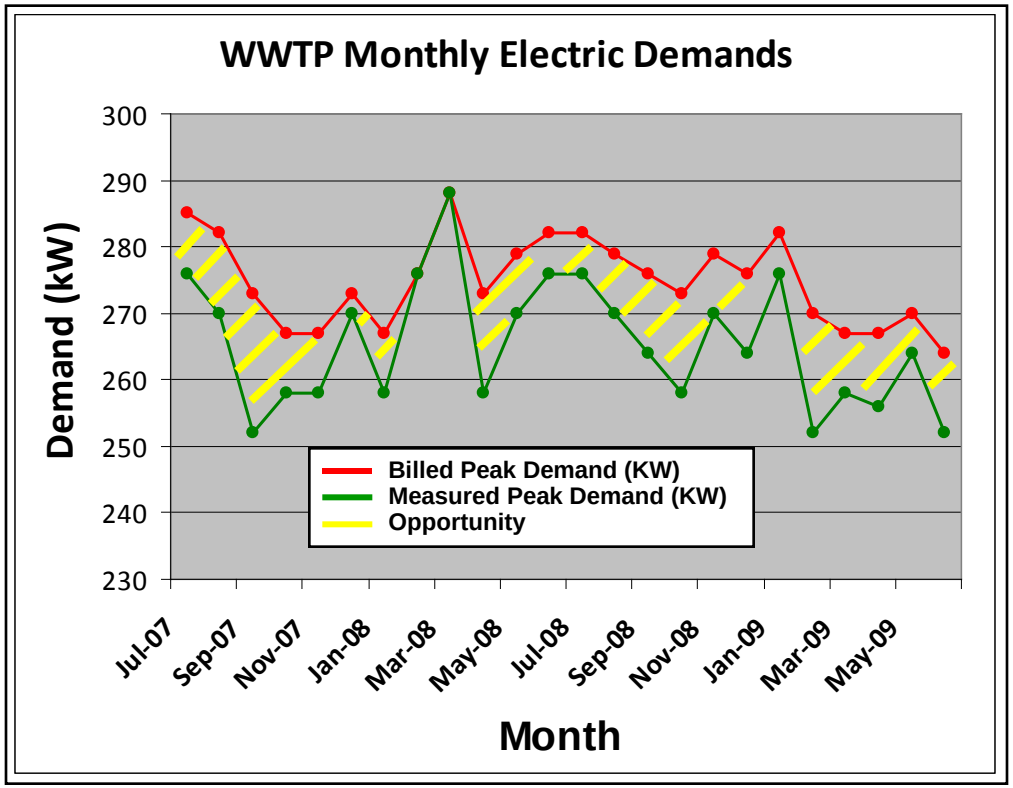



# ECO #1 – Hilo Electric Demand Management

## Hilo's Current Electrical Demands

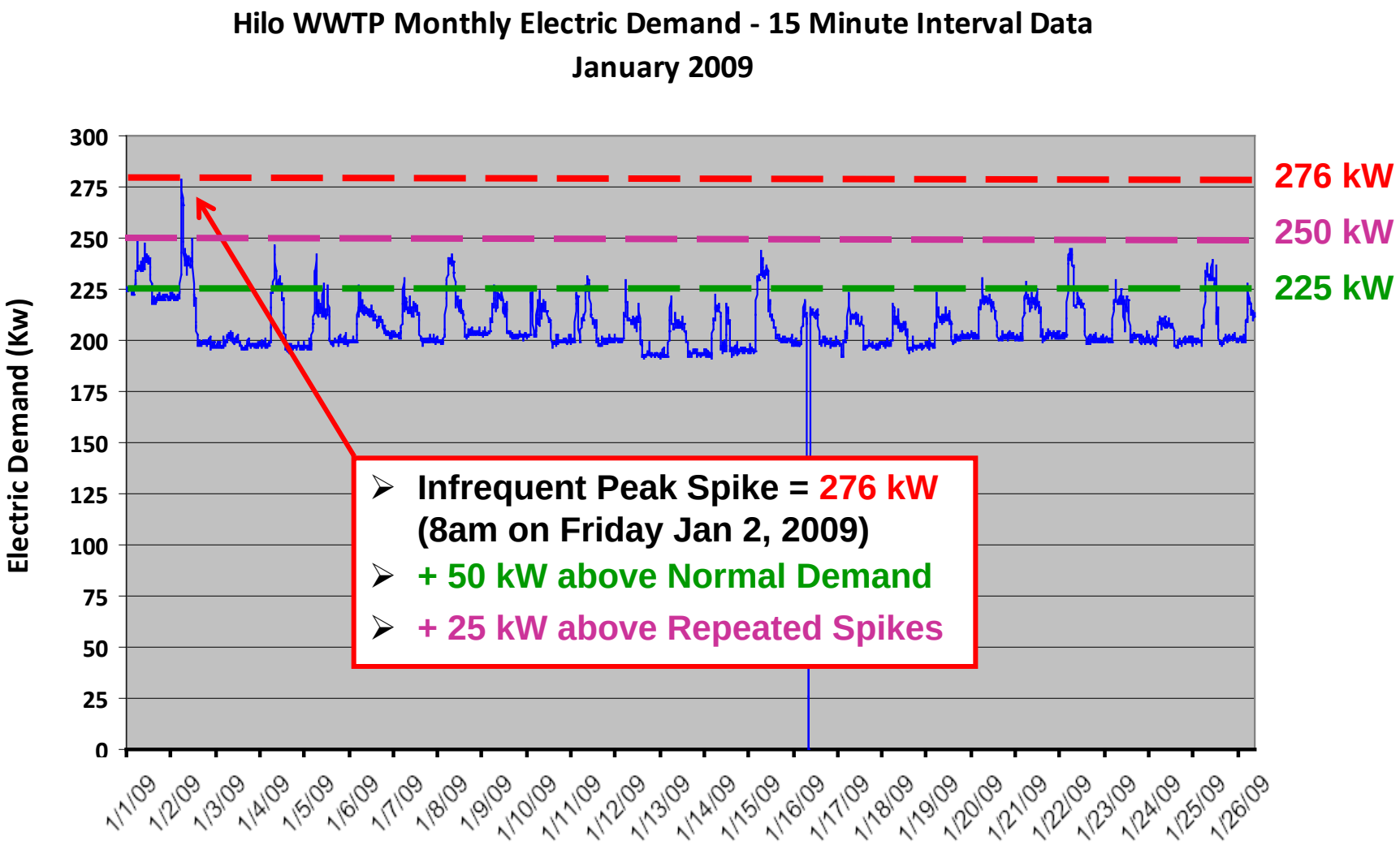
- 15% of site electric costs = >$82k/year*

| Bill Period | Measured Peak Demand (kW) | Billed Peak Demand (kW) |
|---|---|---|
| Jul-08 | 276 | 282 |
| Aug-08 | 270 | 279 |
| Sep-08 | 264 | 276 |
| Oct-08 | 258 | 273 |
| Nov-08 | 270 | 279 |
| Dec-08 | 264 | 276 |
| Jan-09 | 276 | 282 |
| Feb-09 | 252 | 270 |
| Mar-09 | 258 | 267 |
| Apr-09 | 256 | 267 |
| May-09 | 264 | 270 |
| Jun-09 | 252 | 264 |
| **AVERAGE** | **263** | **274** |




* Based on 2009 data collected from January 2009 – June 2009

# Hilo WWTP – Electrical Demand Trend



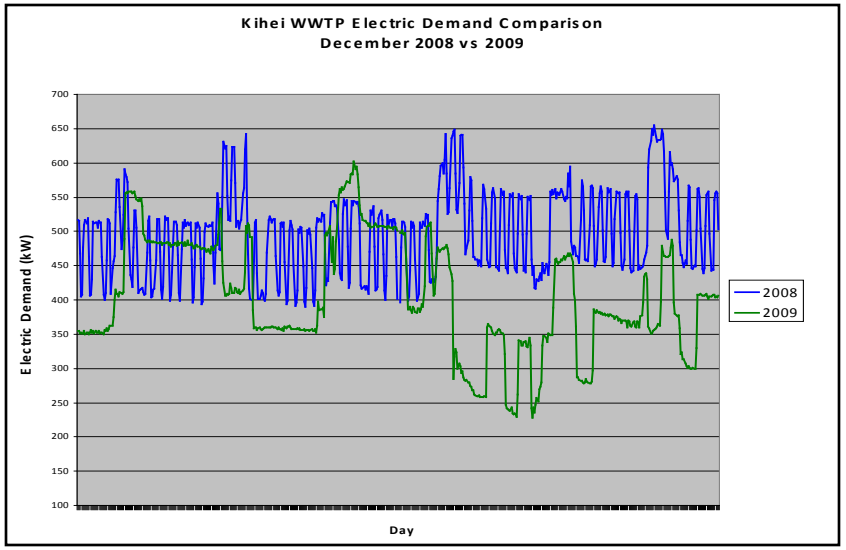
# ECO #1 – Hilo WWTP Recommendation

Electrical Demand Management

- Meter site demand
- Monitoring load data
- Determine spike loads
- Eliminate infrequent spike loads:
  26 kW = $6,700/year
- Reduce regular spike loads:
  50 kW = $12,800/year

# ECO #2 – Kihei Aeration Blower & UV Retrofit

- What a difference a year makes!
- Install new Turblex blower & UV system
- Estimated demand savings ~100 kW
- Estimated electrical savings ~1,000 MWh/yr




# ECO #3 – Kailua UV Disinfection

- Currently off-line pending re-design
- Energy estimates at 15 MGD flow:
  - Old UV ~250 kW
  - New UV additional ~75 kW
- Payback < 2-3 years
- More efficient = less lamps to do the same job!

# Preliminary ECO Results – Hilo WWTP

| ECO No. | Recommendation | Potential Energy Reduction ( kWh/yr ) | Potential Demand Reduction ( kW ) | Potential Water Reduction ( Gal/yr ) | Potential Cost Savings ( $/yr ) | Estimated Implem. Cost ( $ ) | Simple Payback (Years ) |
|---|---|---|---|---|---|---|---|
| **No-Cost Measures** | | | | | | | |
| 1 | Operate Dewatering Odor Control Fan Only During Dewatering Periods | 69,850 | 0 | 0 | $19,100 | $0 | 0.0 |
| **Low-Cost Measures** | | | | | | | |
| 2 | Eliminate 1 Of 3 Primary Tanks In Use And Optimize Primary Sludge Pump Operations | 39,900 | 14 | 0 | $11,200 | $5,000 | 0.4 |
| **Investment Grade Measures** | | | | | | | |
| 3 | Electrical Demand Management | 0 | 26 | 0 | $6,600 | $50,000 | 7.6 |
| 4 | No. 2 Water Pumping System Improvements | 35,000 | 0 | 6,500,000 | $35,700 | $100,000 | 2.8 |
| 5 | Replace Lower Efficiency Motors With Higher Efficiency Motors | 136,400 | 27 | 0 | $44,300 | $175,000 | 4.0 |
| 6 | No. 3 Water Pumping System Improvements | 94,800 | 10 | 0 | $28,600 | $220,000 | 7.7 |
| **Total Potential Electrical Energy Savings** | | **375,950 kWh/yr** | | | | | |
| **Total Potential Electrical Demand Savings** | | | **77 kW** | | | | |
| **Total Potential Water Savings** | | | | **6,500,000 Gal/yr** | | | |
| **Total Potential Cost Savings** | | | | | **$145,400 $/yr** | | |
| **Total Estimated Implementation Cost** | | | | | | **$550,000** | |
| **Total Simple Payback** | | | | | | | **3.8** |

# Preliminary ECO Results – Kailua WWTP

| ECO No. | Recommendation | Potential Energy Reduction ( kWh/yr ) | Potential Demand[1] Reduction ( kW ) | Potential Water Reduction ( Gal/yr ) | Potential Cost Savings ( $/yr ) | Estimated Implem. Cost ( $ ) | Simple Payback (Years ) |
|---|---|---|---|---|---|---|---|
| Investment Grade Measures | | | | | | | |
| 1 | Electrical Demand Management | 0 | 100-350 (738)[2] | 0 | $115,800 | $75,000 | 0.6 |
| 2 | Lighting System Improvements | 122,100 | 25 | 0 | $24,700 | $154,000 | 6.2 |
| 3 | Disinfection System Upgrades | 438,000 | 50 | 0 | $88,500 | $500,000 | 5.6 |
| 4 | Cogeneration | 4,000,000 | 500 | 0 | $658,000 | $3,750,000 | 5.7 |
| **Total Potential Electrical Energy Savings** | | **4,560,100 kWh/yr** | | | | | |
| **Total Potential Electrical Demand Savings** | | | **675-925 kW** | | | | |
| **Total Potential Water Savings** | | | | **0 Gal/yr** | | | |
| **Total Potential Cost Savings** | | | | | **$887,000 $/yr** | | |
| **Total Estimated Implementation Cost** | | | | | | **$4,479,000** | |
| **Total Simple Payback** | | | | | | | **5.0** |

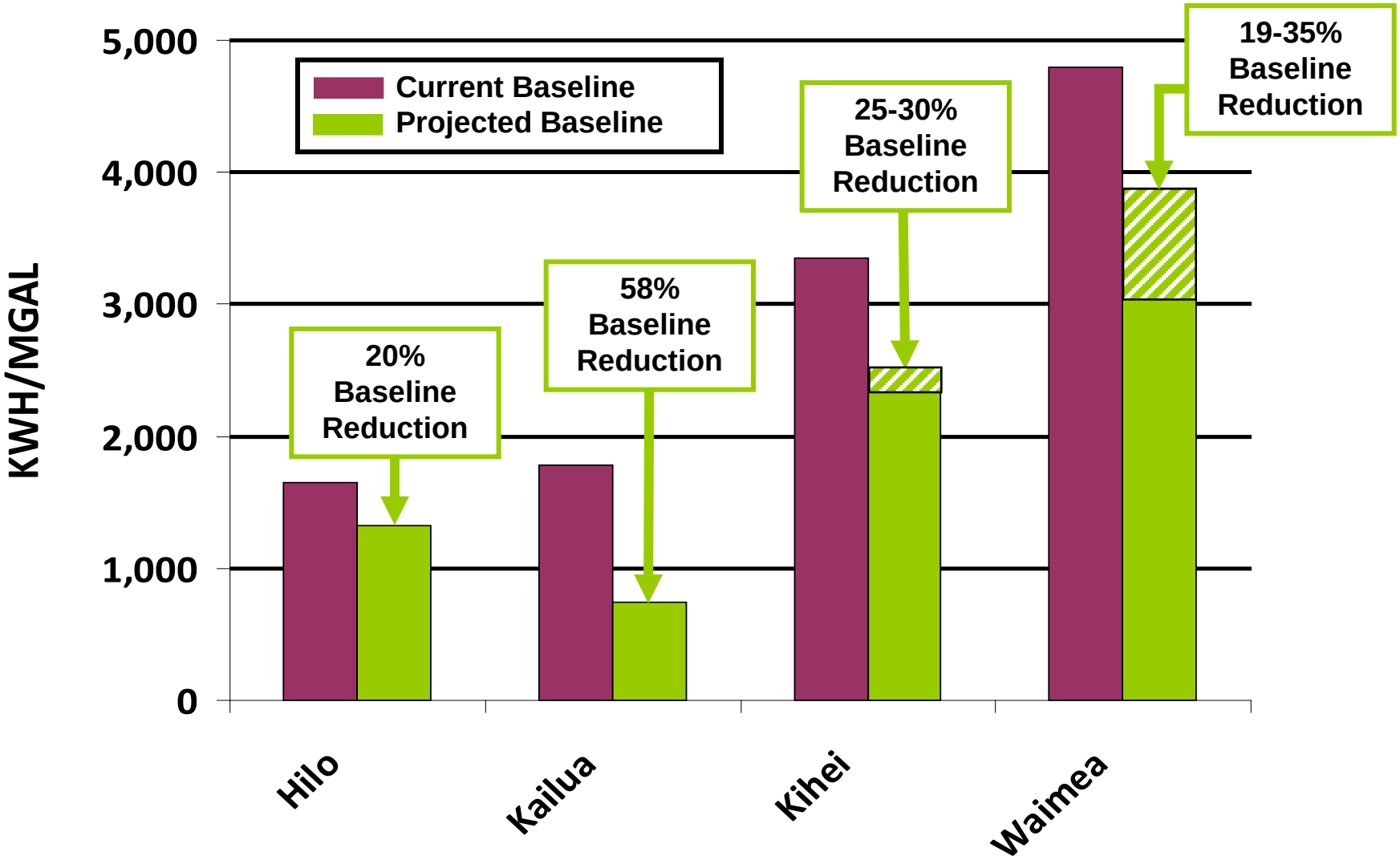
# Preliminary ECO Results – Kihei WWTP

| ECO No. | Recommendation | Potential Energy Reduction ( kWh/yr ) | Potential Demand[1] Reduction ( kW ) | Potential Water Reduction ( Gal/yr ) | Potential Cost Savings ( $/yr ) | Estimated Implem. Cost ( $ ) | Simple Payback (Years ) |
|---|---|---|---|---|---|---|---|
| Investment Grade Measures | | | | | | | |
| 1 | Effluent Water Management | 26,000 | 10 | 0 | $7,000 | $25,000 | 3.6 |
| 2 | Lighting System Improvements | 22,700 | 4 | 0 | $5,000 | $43,000 | 8.6 |
| 3 | Compressed Air System Improvements | 105,700 | 6 | 0 | $20,500 | $130,000 | 6.3 |
| **Total Potential Electrical Energy Savings** | | **154,400 kWh/yr** | | | | | |
| **Total Potential Electrical Demand Savings** | | | **20 kW** | | | | |
| **Total Potential Water Savings** | | | | **0 Gal/yr** | | | |
| **Total Potential Cost Savings** | | | | | **$32,500 $/yr** | | |
| **Total Estimated Implementation Cost** | | | | | | **$198,000** | |
| **Total Simple Payback** | | | | | | | **6.1** |

# Preliminary ECO Results – Waimea WWTP

| ECO No. | Recommendation | Potential Energy Reduction ( kWh/yr ) | Potential Demand Reduction ( kW ) | Potential Water Reduction ( Gal/yr ) | Potential Cost Savings ( $/yr ) | Estimated Implem. Cost ( $ ) | Simple Payback (Years ) |
|---|---|---|---|---|---|---|---|
| Investment Grade Measures | | | | | | | |
| 1 | Lighting System Improvements | 9,140 | 3 | 0 | $2,650 | $7,000 | 2.6 |
| 2 | Effluent Pumping System Improvements | 8,000 | 10 | 0 | $2,320 | $17,500 | 7.5 |
| 3 | Replace Lower Efficiency Motors With Higher Efficiency Motors | 9,600 | 5 | 0 | $2,800 | $23,000 | 8.2 |
| 4 | Install New Direct Drive, Higher Efficiency Blowers With Automated Process Controls | 34,000-84,000 | >6 | 0 | $9,900-$24,400 | $99,000-$244,000 | 10.0 |
| **Total Potential Electrical Energy Savings** | | **60,740-110,740 kWh/yr** | | | | | |
| **Total Potential Water Savings** | | | | **0 Gal/yr** | | | |
| **Total Potential Cost Savings** | | | | | **$17,670-$32,170 $/yr** | | |
| **Total Estimated Implementation Cost** | | | | | | **$146,000-$291,500** | |
| **Total Simple Payback** | | | | | | | **8.3-9.1** |

# Projected Baselines w/ ECO Implementation



# Emerging Stories!  Digester Gas Use!


- Kailua and Hilo equipped with anaerobic digesters
- Both use digester gas for digester heating
- Excess gas is burned (Flare stack)
- Cogeneration study for Kailua (2004) indicated 600 KW cogen system possible with 13 MGD flow
- Cogeneration study is being updated, expected in 2010

# Emerging Stories!  Digester Gas Use!

- General rule of “thumb” 1 MGD ~30 KW cogen
- Options to make more digester gas:
  - Enhance digestion
  - Fat, oil & grease (FOG) addition
  - Other bio-waste

EPA

# Emerging Stories!  FOG

- High heating value (BTU)
- Excellent fuel source
- Disposal down the drain results in collection system blockages & headaches
- FOG recovery and reuse programs being developed throughout the world
- Keeps FOG out of landfills
- Could result in revenue source for agency

EPA

# RENEWABLES! Location.. Location

- Solar
  - Waimea WWTP
- Wind
- Geothermal (deep well)
- Bio-mass (digesters)
- Hydropower (micro-turbines)

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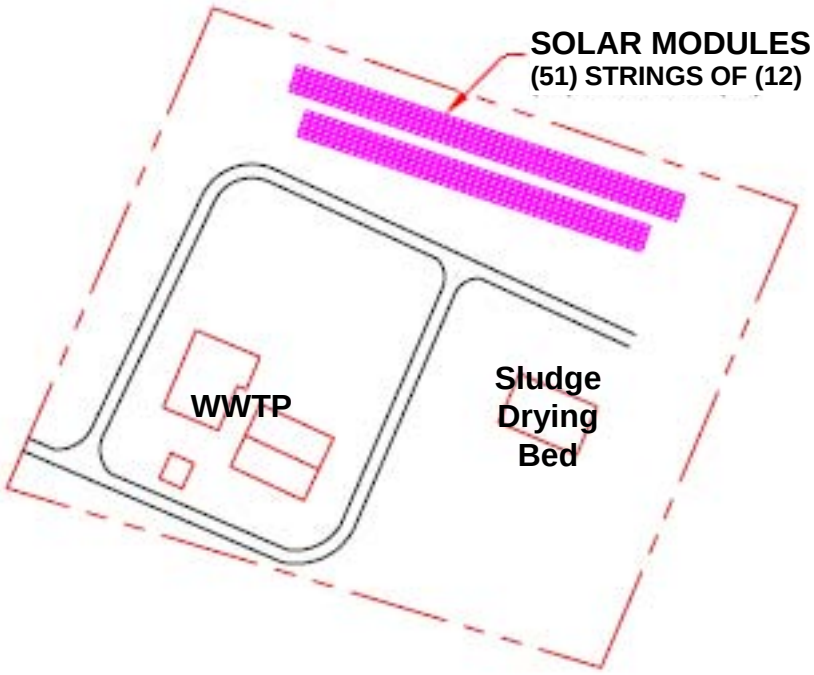
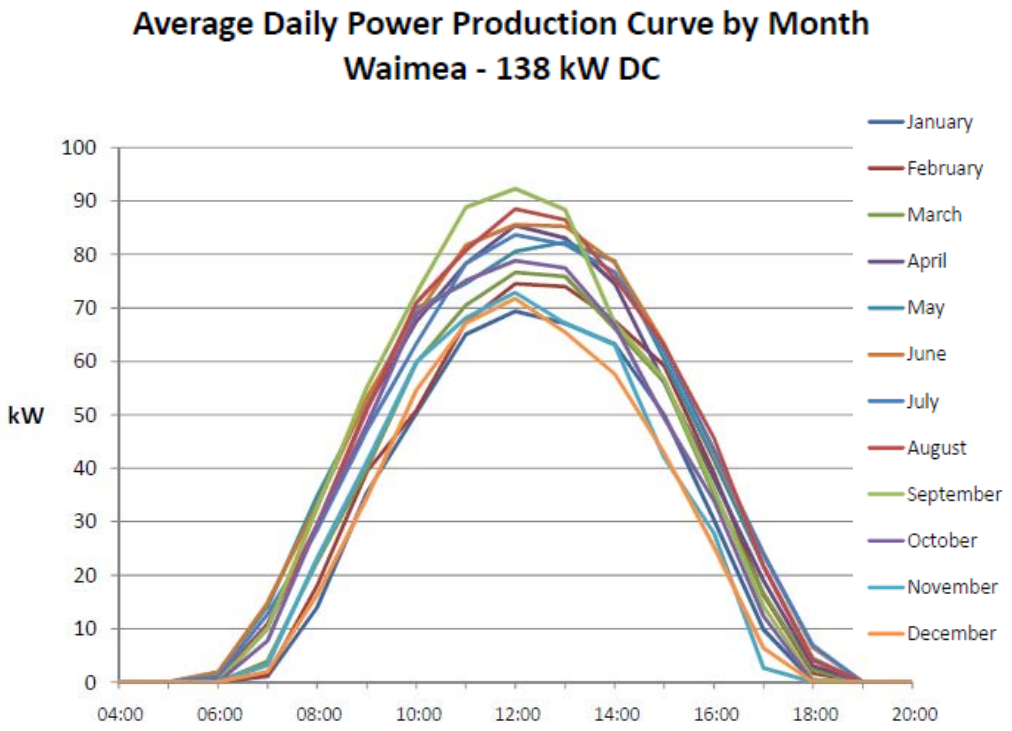
# Waimea Solar PV System




- Proposed design:
  - 137.7kW DC
  - 112.9kW AC
  - Polycrystalline type
  - 612 REC AE-US 225W DC modules at fixed tilt (www.recgroup.com/usa)
  - Size of approximately 11,000ft$^2$

# Waimea Solar PV System Cont…

- PV system cost
  - $799,194
- Est. energy impact
  - 203,077kWh/year
  - 65% of current electric use
  - $58,892/year*
- 13.5year* SPB




* $0.29/kWh and does not include rate schedule impacts or escalation over time

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# Energy Audit – Do's and Don'ts

- Three key's to effective auditing:

  "Information, *information*, & information!"
- Enlist team concept with plant personnel actively engaged in auditing
- Look beyond the numbers
- Understand local requirements and prohibitions

# Energy Audit – Do's and Don'ts Continued…

- Confirm assumptions
- Evaluate "aggressively" but "keep it real"
- Make the auditing process a learning experience for *all participants*

# Conclusions!

Good information + Right audit team

=

Enhanced energy utilization +

Increased operational understanding + $$$

- Learn from the experience
- Better resource utilization awareness
- Energy / resource management improvements

# MAHALO!


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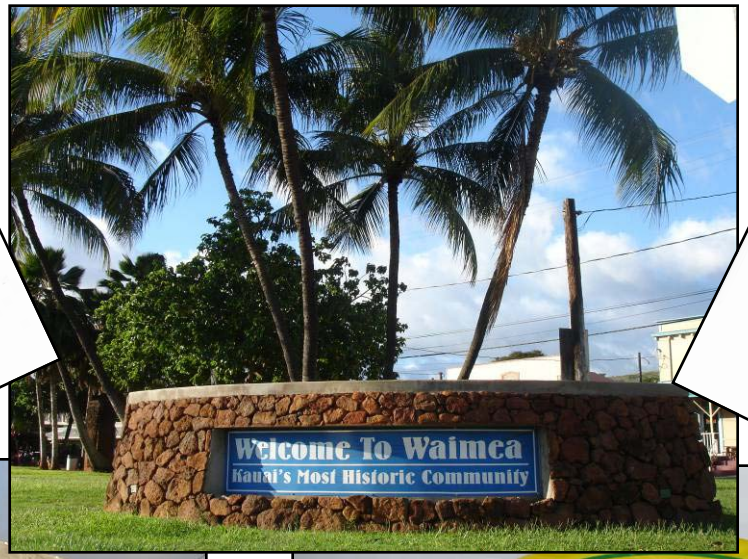
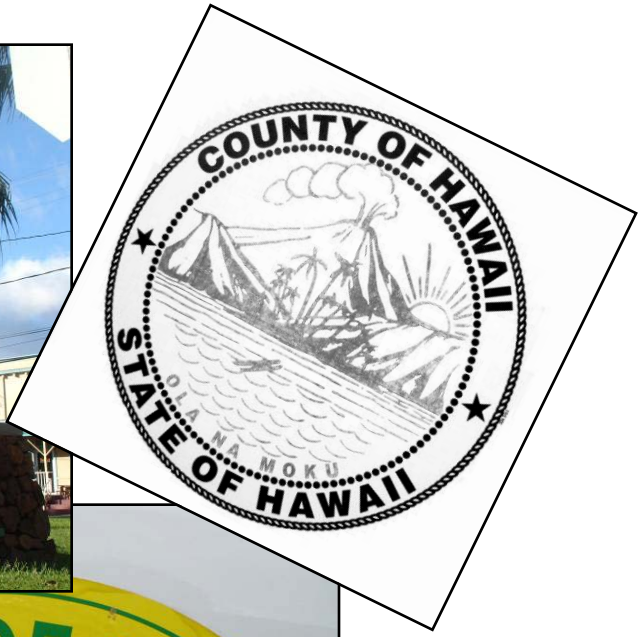
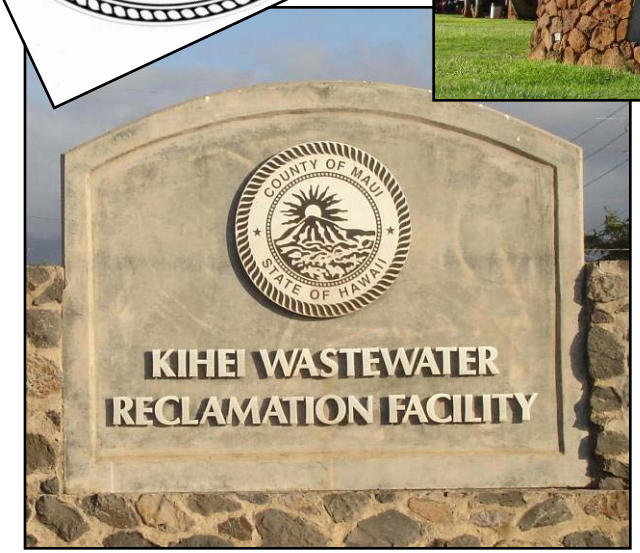
ENVIRONMENTAL SERVICES
TREATMENT & DISPOSAL
CITY & COUNTY OF HONOLULU


Welcome To Waimea
Kauai's Most Historic Community


COUNTY OF HAWAII
STATE OF HAWAII
OLA NA MOKU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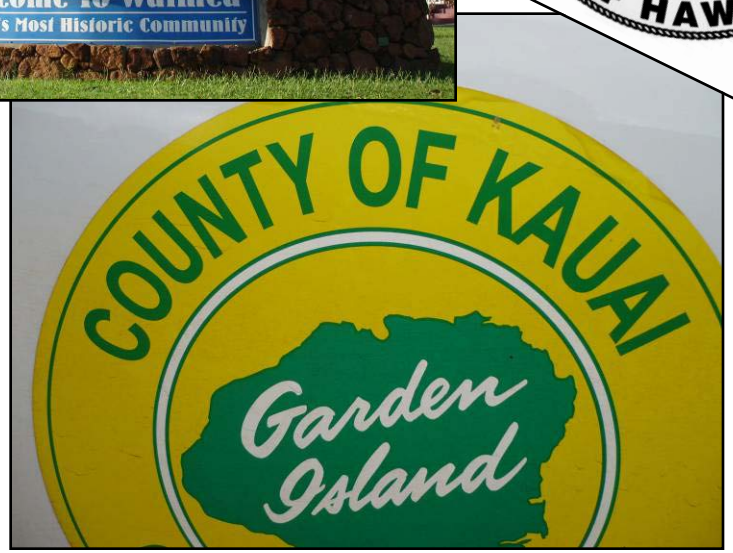
KIHEI WASTEWATER
RECLAMATION FACILITY


COUNTY OF KAUAI
Garden Island

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